TELEPHONE

Volume XVI

TOWER-BINFORD ELECTRIC & MANUFACTURING Co
ELECTRICAL APPARATUS AND SUPPLIES
RICHMOND VIRGINIA

GAT-B

May 26th, 1916.

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Oshkosh, Wis.

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Editors: ED. J. MOCK, PAUL H. WOODRUFF
New York Representative: CHARLES R. CONDON
New York Office, 1022 Longacre Building
Forty-second St. and Broadway
Telephone Bryant 7030

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VOL. XVI CHICAGO, NOVEMBER, 1916 NO. 5

Selling Independent Equipment to the Bell Companies

THE prospect that interests Independent manufacturers in their agitation for the dissolution of the Bell-Western Electric relations is the possible opportunity for selling Independent equipment to the Bell companies. It is logical to assume that, the Western Electric being made independent, the whole market for telephone supplies would be thrown open. The Western Electric would sell its goods to its share of Independent customers (which, to a considerable extent, it already does) and the Independent manufacturers would sell some of their goods to the Bell companies (which business they do not now enjoy in any degree).

Independent operating companies which now buy from the Bell factory have three possible reasons for doing so: The bid is the lowest, or they prefer Bell apparatus, or they wish to establish a friendly relation with the Bell forces for their own reasons.

Independent operating companies which now refuse to buy from the Bell factory do so for one of three possible reasons: The bid is not the lowest, or they prefer Independent apparatus, or they are opposed to the principle of buying from a competitor.

Of these hypothetical six classes of buyers, the Bell factory has at present as much opportunity to deal with the first five as it would have if it were independent of the Bell. Presumably they buy or refuse to buy on purely commercial principles.

The sixth class (numerically a large one, we believe), those to whom the Blue Bell is a red flag, will have nothing but apparatus carrying the Independent Shield. The Western Electric, with all Bell influences expurgated from its system, would stand a better chance for business with these companies than it does now. And with the ordinary luck of business, it is presumable that it would gain some customers among them by assiduous sales argument.

Out of six classes of buyers, then, logically an independentized Western Electric would find a new selling field in only one class. And in that class it would, of course, be in open competition with the other (Independent) manufacturers and run the ordinary chances of business competition.

The possible gain in Independent customers by an independent Western Electric appears on analysis, therefore, less formidable than it seems to casual consideration.

The sale of Independent apparatus to Bell companies in an open market, with a fair field and no favors, would mean a large increase in business for the Independent factories. It is reasonable to assume that this gain would be very much greater than the probable gain of the Western Electric in the Independent operating field. The Independent manufacturers would lose a little old business and gain a good deal of new business.

This is predicated, as we said before, on the hypothesis of a fair field and open competition. It presumes that all the telephone manufacturing companies would have equal facilities and equal opportunity for presenting the lowest bid for any order. It also supposes that the purchaser will always accept the lowest bid, and apparently relies upon commission regulation to enforce that procedure.

The assurance that Bell operating companies were actually accepting the lowest bid for each order would be the only proof available to Independent manufacturers that any Bell-

Western Electric separation was genuine. If, after such a separation, a Bell company persisted in buying all, or the major part, of its equipment from the ex-Bell factory, the Independent manufacturers could be pardoned for suspecting a continued relation of some sort.

Yet it might be difficult to make regulating bodies and public officials share that suspicion. The Bell operating company that wished to reject a low Independent bid could always argue the advisability of using new equipment identical with its existing installation. Telephone men of unbiased mind would not accept this argument. Public utility commissioners, on the contrary, would be very likely to accept it.

This is the only reason we have opposed the theory that more business would result to Independent manufacturers from the dissolution of the Bell-Western Electric relation. Our respect for the business ability of all the parties involved in the discussion need not deter us from saying what must be in the mind of every man who has seriously studied the problem: That the brilliant minds at the command of most large corporations can always find ways of circumventing an official order that they do not regard as reasonable; and that a dissolution of the kind mentioned never succeeds in convincing everybody that it is genuine and absolute.

If the Bell companies are really willing to buy in the open market, as has been claimed; if the genuineness of a dissolution would be capable of proof; or if the regulating bodies could be depended upon to enforce the rule of the lowest bid, then the divorce of the Bell and its factory could be expected to develop new business for the Independent factories. But if none of these conditions was assured, the Independents would gain a doubtful advantage.

Chicago's Eight Million Dollar Suit

IT has been suggested that the suit of the Chicago Tunnel Company against the American Telephone and Telegraph Company for eight million dollars, alleging that the latter company broke its contract to purchase the telephone property of the former, may be a friendly suit. Those who hold this theory argue that an Illinois state court might reasonably be expected to base its decision upon the contract, without regard for possible reasons why it might not have been fulfilled. A court opinion that the contract was valid would make the sale of the property a completed transaction. The sale would, of course, still lack the approval of the United States government; but it must be remembered that the Department of Justice has never positively disapproved it. The Tunnel company claims that it fulfilled its part of the contract by obtaining, as an intra-state company, the permission of the state and city authorities for the merger. The federal authorities simply declined to express any opinion whatever on the legality of the situation.

If the decision of the state court actually completes the merger, its opponents can only see that it is carried into the federal courts, where it would doubtless drag along for several years before it produced a decision that would serve as a reference for other merger cases. And inasmuch as the Chicago negotiations were started before the advent of the notorious Kingsbury commitment, and it is always harder to undo a transaction than to prevent it, the decision might not be useful to Independent telephony, when it did arrive.

It seems hard to get rid of the Chicago case. It has more lives than an athletic cat. What a pity it is that more deserving telephone companies have so much less vitality.

The Extension of Regulation

THE coming convention of state railway commissioners, and the probable discussion of their jurisdiction over telephone properties, brings up the possibility of an extension of the powers of the Interstate Commerce Commission. Many telephone men are opposed to any increase in federal regulation because it would not be accompanied by a corresponding decrease in state regulation, and the net total of regulation would become greater.

There is no question that a great many functions of state regulation could be transferred to the Interstate commission with advantage to all concerned. It is particularly desirable that the Interstate body recognize the legitimate demand for universal physical connection—though the claim is made by some that no extension of power is necessary to effect that, but only the application of existing common carrier laws.

The National Council of the Chamber of Commerce of the United States will meet in Washington, November 17, to discuss the problem of getting rid of forty-nine different regulatory jurisdictions, and its conclusions will hold a great deal of interest for telephone men.

The Second Company Is the Goat

THE Oklahoma Corporation Commission, vexed by a complaint that the Bell company operating in that state has reduced rates to stifle competition in certain communities, has formulated a brand new and distinctly original ruling to cover the situation:

> The commission hereby adopts the policy that where there is a telephone exchange already in a town and a second exchange is put therein it enters the field at its peril. The commission will afford it no relief against the original company which enters the field first in cutting rates even below a reasonable return on the investment. But where a second company enters a field already occupied by a telephone utility the commission will not permit it to reduce rates so low as to destroy the property of the company which built the first exchange. The same rule applies to long-distance lines.

It so happened that the Bell company was the "original" company in the cities involved in the complaint. That, however, is merely a circumstance. The danger of the ruling lies in its very equality and apparent fairness. The second company to enter the field, whether it be Independent or Bell, gets no protection from the commission.

Now it is a condition not unknown to telephone history that the second company is the vital element in the situation. It frequently enters the field because the public wants relief from the methods of the first company. The majority of "second" companies came to the rescue of the people before there was any such thing as commission regulation. Their presence, and the natural regulative effect of their competition, made it easy for the commissions to control the situation.

Yet here is a commission that boldly says "The first company is always right; the second company is always wrong." It practically encourages the first company to take any steps its ingenuity suggests to drive the second company out of business. In the specific case mentioned it gives the first company permission to practice discrimination in rates, that the second company may be ruined quickly and expeditiously.

With such an object lesson in a neighbor state, we do not wonder that Texas telephone men are violently opposed to commission control.

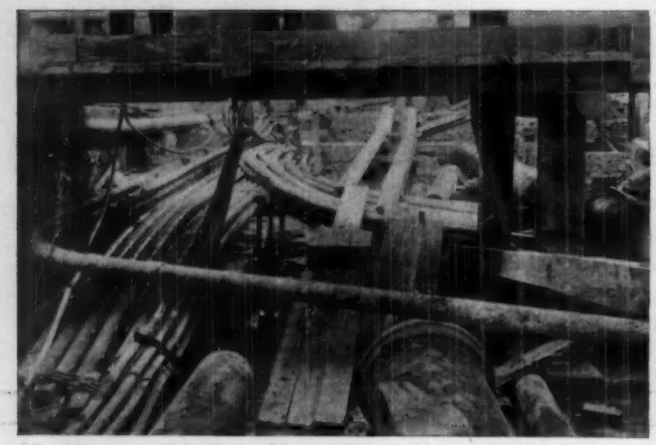
National Convention December 5, 6, 7 and 8

United States Independent Telephone Association

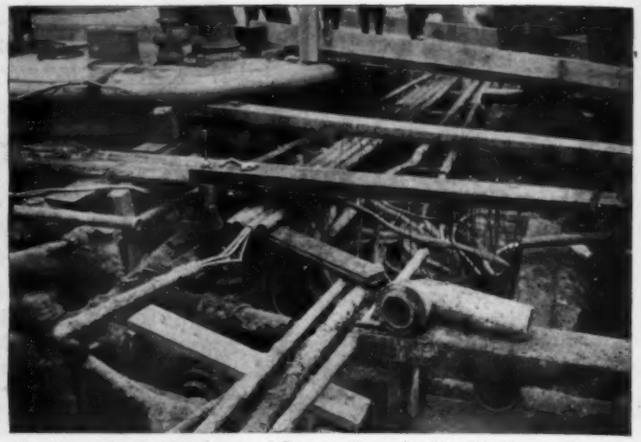
The Annual Convention of the United States Independent Telephone Association will be held in Chicago at the Hotel La Salle, December 5, 6, 7 and 8—a four-day convention. Every one of the sixty rooms on the seventeenth floor of the hotel will be occupied by exhibitors of telephone equipment and supplies. Telephone Engineer will have its convention headquarters in Room 1757, where all visitors are invited to call. The mornings of the convention days are to belong to the exhibitors; all meetings are to be held in the afternoons.

A program has been prepared which provides meetings of interest to all departments of the telephone industry. This convention will be the culmination of a year of exceptional activity by the Association. The year's work will be forcefully presented; opportunity will be given for suggestion and criticism of Association plans and purposes. Speakers of national reputation will handle the technical and commercial topics. Three addresses on general subjects by men known to the whole country are being provided; one to be delivered at the banquet. Special entertainment is planned for the ladies who are invited to every session.

The general manager, the lineman, the president, the auditor, the wire chief, the chief operator, the treasurer, the plant superintendent—all should plan to attend this great National Convention. Get in touch.



Dey Street at West Intersection of Church Street. Looking West from East of West Curb of Church Street Showing the Two Banks of Empire City Subway, 18 Ducts at Left, and 22 Ducts Curving to the Right. A Western Union Telegraph Box Is Shown at Right.



Northwest Corner Broadway and Broome Street Looking Northwest Showing Manhole and Pipes Surrounding Same.—Telephone Review.

The Lebanon, Tenn., exchange recently suffered what is believed to be the record for damage from one stroke of lightning, states the Southern Telephone News.

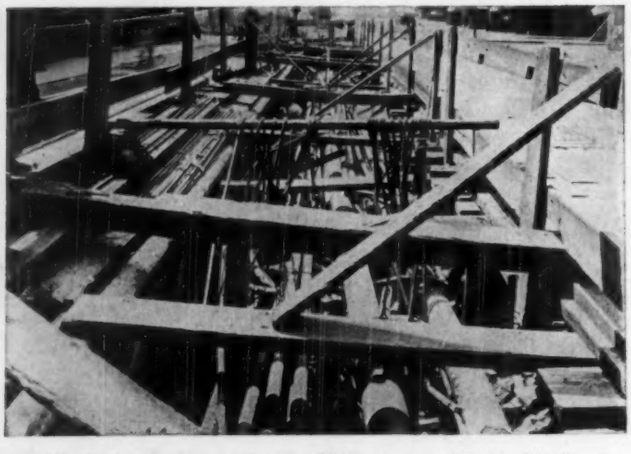
This stroke of lightning burned one span of an open wire route of thirty wires before it hit the cable, and 380 feet of fifty pair cable was burned so badly that it had to be replaced. It was also necessary to replace sixteen feet of one hundred pair cable and ten feet of 150 pair. One twenty-five pair pot head on the end of a route was burned and four 14-C terminals were damaged beyond repair.

The 400 pair leaving the office, which is approximately three-fourths of a mile from the end of the cable, was burned in two places.

In the city 92 telephones were put out of order and 16 telephones on farmers' lines were rendered useless. It required ten days' work by two cablemen and the regular force to restore the service and three men worked three weeks making permanent repairs.

"The telephone system here is subject to similar damage by lightning during the summer months. We have taken every precaution to protect our plant, but lightning cannot be foreseen and the extent of the damage cannot be anticipated," announces the company to its subscribers.

"Should your service be affected by lightning you may be sure we are exerting every effort to restore it as quickly as possible."



East Side Lexington Avenue, Between Eighty-fourth and Eighty-fifth Streets Looking South Showing General Conditions Under Which Existing Empire City Subway of 27 Ducts Was Built in New York City—Telephone Review.

In the cellar of one of the large mercantile houses in Allentown, Pa., one of the cables obstructed the progress of a rat that was gnawing his way through to the next cellar, so Mr. Rat just chewed up enough of the cable to permit easy access.—The Mouthpiece.

STORIES IN PICTURES OF TELEPHONE PRACTICE AND PROGRESS IN ALL PARTS OF THE WORLD.

How Near We Came to Government Ownership

The History of the Telegraph Is Full of Romance

BY CHARLES E. BENTON

THE electric telegraph has become so much a necessary part of our daily life that it is almost startling to reflect that there are some among us who were living at the time of its invention. Stranger still would it seem to those radical persons who propose that the government shall take over the whole system of telegraphs, to be told that at its introduction it was contemplated that telegraphing should be a government function, and that sending messages for private parties was a possible side issue. Yet this was the case. February 3, 1837, Congress passed the following:

Resolved, That the Secretary of the Treasury be requested to report to the House of Representatives, at its next session, upon the propriety of establishing a system of telegraphs for the United States.

The secretary at that time was Levi Woodbury, and he at once set about the task of gathering the desired information on the subject. To do this he hit upon the excellent expedient of sending out a circular letter, addressed to "certain Collectors of Customs, Commanders of Revenue Cutters, and other persons." This circular, as representing the first move of the government to gather information on the subject, I consider so important that I quote it entire:

Treasury Department, March 10, 1837.

With a view of obtaining information in regard to the propriety of establishing a system of telegraphs for the United States, in compliance with the request contained in the annexed resolution of the House of Representatives, adopted at its last session, I will thank you to furnish the Department with your opinion on the subject. If leisure permits, would you oblige me by pointing out the manner, and the various particulars, in which the system may be rendered most useful to the government of the United States and the public generally. It would be desirable, if in your power, to present a detailed statement as to the proper points for the location, and distance of the stations from each other, with general rules for the regulation of the system, together with your sentiments as to the propriety of connecting it with any existing department of the government, and some definite idea of the rapidity with which intelligence could ordinarily, and also in urgent cases, be communicated between distant places. I wish you to estimate the probable expense of establishing and supporting the telegraphs, upon the most approved system, for any given distance, during any specified period.

It would add to the interest of the subject if you would offer views as to the practicability of uniting with a system of telegraphs for communication in clear weather and in the day time, another for communication in fogs, by cannon or otherwise; and in the night, by the same mode, or by rockets, fires, etc.

I should be gratified by receiving your reply by the first of October next.—LEVI WOODBURY, Secretary of the Treasury.

The responses to this circular were both numerous and interesting, but all except one dealt with the telegraph as it was then known. Mr. Woodbury selected such of these letters as seemed most pertinent to the subject, submitting them with his report. It should be understood that the telegraph had already been in use for several years in some portions of Europe. Its apparatus consisted of signals displayed on poles—arms during the day and lights at night—and by means of shifting their relative positions intelligence was conveyed for several miles, from and to successive stations. It was found impracticable to have these stations more than about seven or eight miles apart.

There is a story related as to the origin of this invention. In Italy the government has always been the manager of lotteries, which were quite customary at that time, and the drawing of the numbers to decide the lucky ones was held in Rome and Milan. These two cities were some twelve hours' travel apart, and when a drawing was held in one of them, tickets continued to be sold in the other, for many hours; in fact until nearly time for the arrival of the post with the news of the drawing. Certain individuals invented a method of conveying, by signals, the numbers that had won. Then their confederates would walk into the lottery office and place their money on those numbers. Of course the rascals were found out in time, as they were sure to be, and their invention published to the country. But the man who gets credit for the invention, since he first perfected it and brought it into public service, was Monsieur Chappe, a French artist, and through it correspondence was opened between Paris and the French army then at Lisle. This was in 1793.

On December 6, 1837, Mr. Woodbury submitted his report to the House of Representatives, and five days later it was laid on the table. This report is only a document of some four hundred words, but the replies from those to whom the circular of inquiry had been sent, and which to the number of seventeen he submitted with the report, make it most interesting, and it is worthy of note that the constant thought running through these letters is, that the telegraph, if adopted, is to be a government enterprise. But the ones which most interest us today are those from Samuel F. B. Morse, an American artist who had spent several years of study and work in Europe, and was already distinguished. His letters are too long to be included here, but I will quote from them. His first letter is dated September 27, 1837, in which Mr. Morse writes as follows:

With regard to telegraphs constructed on ordinary principles, however perfected within the limits in which they are necessarily confined, the most perfect of them are liable to one insurmountable objection—*they are useless the greater part of the time.* In foggy weather, and ordinarily during the ntght, no intelligence can be transmitted. Even when they can transmit, much time is consumed in communicating but little, and that little not always precise. Having invented an entirely new method of telegraphic communication, which, so far as experiments have yet been made with it, promises results of almost marvelous character, I beg leave to present to the Department a brief account of its chief characteristics.

About five years ago, on my voyage home from Europe, the electrical experiments of Franklin, upon wire some four miles in length, was casually recalled to my mind in conversation with one of the passengers, in which experiment it was ascertained that the electricity traveled through the whole circuit in a time not appreciable, but apparently instantaneous. *It immediately occurred to me that if the presence of electricity could be made visible in any desired part of the circuit, it would not be difficult to construct a* SYSTEM OF SIGNS *by which intelligence could be instantaneously transmitted.* The thought, thus conceived, took strong hold of my mind in the leisure which the voyage afforded, and I planned a system of signs, and an apparatus to carry it into effect. I cast a species of type, which I had devised for this purpose, the first week of my arrival home; and, although the rest of the machinery was planned, yet, from the pressure of unavoidable duties, I was compelled to postpone my experiments, and was not able to test the whole plan until within a few weeks. The result has realized my most sanguine expectations.

(The italics in the foregoing are Mr. Morse's.)

The letter goes on to describe the advantages that may be expected from the introduction of his electric telegraph, and in a letter to the *New York Journal of Commerce*—which is also included in the report—he

gives the dot-and-line alphabet which he had invented; the Morse alphabet, it is called; the same that is still in use. The concluding paragraph of the first letter shows a fine patriotic spirit worthy of imitation at the present day:

In conclusion, I would say that if the perfecting of this new system of telegraphs (which may justly be called the American telegraph, since I can establish my claims to priority in the invention) shall be thought of possible utility, and worthy the attention of Government, I shall be ready to make any sacrifice of personal service and of time to aid in its accomplishment.

Mr. Woodbury, in his report to Congress already referred to, made the leading suggestion that—"It might most properly be made appurtenant to the Post Office Department." It was the parting of the ways! But our government did not act upon the suggestion, and the wonderful invention passed into private hands, with the results of which we are familiar. But the end was not yet. Mr. Morse continued to work on his invention through various vicissitudes of good and bad fortune, until 1844, when he succeeded in establishing a telegraph line from Washington to Baltimore. That date may be considered the beginning of telegraphy, and from that date the inventor's success was assured, and he received not only riches, but honors such as come to but few. The simplicity and grandeur of his character made him a worthy recipient.

This is the story of the telegraph at its beginning, and it shows how easy it would have been at that time to have made it a government institution. That the government did not take this step may have been because the members of congress were ordinary men, lacking in the prophetic quality necessary to enable them to foresee its possibilities. Or—could they have been influenced, possibly, by some who did foresee? We shall never know.

There is a story told in connection with the establishment of the telegraph as a financial enterprise that is too good to be omitted. It was at first proposed that the wires be insulated, and buried in the ground by trenching. Ezra Cornell was at that time a hustling Yankee who was trying to introduce a new plow. The new telegraph company which was promoting the enterprise applied to him to take stock. He looked the matter over in true Yankee spirit, and finally offered a "trade."

"You will need plows to make the trenches," he said. "If you will take my plows I will take stock in your company." And they accepted his terms.

Shrewd Ezra! You were shrewder than you knew! The wires were finally raised above the ground, and the plow passed into oblivion, but that telegraph stock laid the foundation of the fortune which enabled him to build and endow Cornell University at Ithaca, New York.

Chicago Bell-Automatic Squabble

Charging breach of contract, the Chicago Tunnel Company the first part of October filed suit for $8,000,000 against the American Telephone and Telegraph Company because of its refusal to complete the deal for its purchase of the automatic telephone system.

On September 21 when the ordinance authorizing the sale lapsed because of the non-payment of $500,000 compensation to the city within the six months allowed by the city council only one reason was given as the cause for the failure of the Bell company to close the deal. That was the refusal of Attorney General Gregory either to approve or to disapprove the transaction. His ruling was that the department of justice could not give advance opinions on such a merger.

The attitude of the tunnel company is that it was not required to obtain the approval of the department of justice as one of the requirements of the sale. The contract between the companies required the vendor to obtain the consent of all governmental agencies whose consent would be necessary to legalize the sale. The tunnel company contends that it fulfilled this part of the agreement by obtaining the consent of the city council and the approval of the state utilities commission.

The praecipe in the suit was filed in the circuit court by two law firms—Schuyler & Weinfeld, who represented the tunel company throughout the negotiations, and Winston, Payne, Strawn & Shaw, probably the largest in Chicago, who have represented the bondholders only until now. The two firms now jointly represent the company.

"The plaintiff company," said Daniel J. Schuyler, Jr., of the former firm, "obtained the consent of all other parties concerned and expected the deal to go through. It was not expected that the defendant corporation would refuse to carry out the agreement. It has refused and the suit is for damages, expenses, and interest. The purchase price agreed upon was $6,300,000."

The city council gas, oil and electric light committee turned down a "compromise offer" of the Chicago Tunnel Company to settle the automatic telephone controversy the last part of the month.

This is the proposal presented by S. W. Tracy, vice-president of the company:

That the city permit the company to discontinue the operation of its automatic telephone system and sell its tangible property.

That in return the city would be paid approximately one-fifth of the amount expected to be received for the property, or $235,000.

That the city should also receive one-fifth of the amount derived from the American Telephone and Telegraph Company, should the tunnel company's suit for breach of contract to buy the automatic system be successful.

The committee voted unanimously in favor of filing the proposal and action on the proposed forfeiture ordinances was postponed until the next meeting, to give Mr. Tracy and Ralph M. Shaw, attorney for the bondholders, opportunity to present a revised proposal.

This is what was suggested to the tunnel company representatives:

That the company pay to the city in return for permission to "junk its plant" $500,000.

That if the company will pay $500,000 another offer, better than the one submitted previously, be made.

Attorney Shaw pleaded with the committee to accept the offer made.

"If you accept this proposition you will save the city money and save the company money as well," he said. "If forfeiture proceedings should be successful the property of the tunnel company would depreciate during the proceedings so that the city would gain a barren victory.

"We figure we could sell out at prevailing prices for about $1,750,000. Under the company's proposal the city would receive approximately $235,000, and would also have an interest to one-fifth in the lawsuit against the A. T. & T."

The Wireless Telephone of the Future

A Study of Chief Engineer John J. Carty, in the New York World

BY HENRY N. HALL

THIRTY-SEVEN years ago in Boston a rather shy lad of eighteen, passing a store where scientific apparatus was sold, saw a "Boy Wanted" sign. That store had always had a strange attraction for him. The Crookes tube in the window and the radiometers and the telescopes were a delight to his heart, and he had often longed to get inside and fondle them. He walked by on one side of the street and then on the other. Finally mustering up his courage he crossed over, took down the sign, put it under his arm and went in. The proprietor was quickly persuaded that he was the boy wanted.

This is how John J. Carty, now the chief engineer of the American Telephone and Telegraph Company, the man under whose direction was wrought the wonder of wireless telephony and who is recognized as without question the greatest telephone engineer in the world, started life. It was not exactly what he had expected, for he was a graduate of the Cambridge High School and had about completed his preparations for entering Harvard when trouble with his eyes forced him to abandon study.

As he had a clear, keen mind, a natural liking for mechanical experimentation and an infinite capacity for work, he didn't stay an office boy long. His next job was as operator in the telephone company, then just started. A few years later an old lady painfully toiled up the long flight of stairs that led to the telephone office. Out of breath, she sat down, and when she had recovered sufficiently to speak she said she wanted to talk with her son in Chicago. The operators laughed boisterously at the old lady, all except young Carty. He didn't laugh. He explained to her that the wires extended only a few miles out of Boston, but when she was gone he turned to the others and said: "You fellows don't need to laugh. Some day we will talk to Chicago. We will put lines through to Chicago, and we may go even further than that." He got jeered at for his pains.

Eighteen years later he was instrumental in putting through a line to Chicago. Four years ago it was extended to Denver, and on January 25, 1915, he completed a transcontinental line from New York to San Francisco. On September 30 last he succeeded in throwing the human voice by telephone through space, without the aid of wires, and men speaking in New York were heard and their voices recognized in Panama and in California. The crowning achievement was a conversation held across the Atlantic, one man sitting in New York and the other in Paris, and what they said was heard in Honolulu! What does it all mean, where will it lead to? Those were the thoughts that forced themselves forward as I talked with Mr. Carty, and he said:

John J. Carty

"I would pity the man who could use a wireless telephone without a feeling of awe. It seems as though the voice comes from the beyond. There is something that makes us pause, that makes us reverent; something that makes it impossible to think of business profits, but inspires us with an ideal of service, almost sacred in character.

"It is so big that we puny mortals can as yet form but a poor conception of it.

"We have built up in this country a great, a universal system of communication, reaching from the Atlantic to the Pacific, by means of which the people of the United States hold more than 9,000,000,000 conversations in the course of a year over some 21,000,000 miles of wire. Suddenly we find that the achievement of which we are so proud is only a very little system, and that in a few years you will be able to speak into any telephone and your voice will be heard at the North Pole, or the South Pole or in the Sahara Desert just the same as across the street. So far as the electrical problem is concerned, there is no reason why any human could not listen with a telephone at his ear, and they could all be provided with sufficient current so that they could all hear at once.

"And yet that is as nothing compared to the other and the greater thing. We use a conductor that does not only connect New York with Paris and Panama, but which connects up all creation. It is the ether. The transmission of the human voice and the extension of this wonderful conductor is not limited to the earth. It goes off into the sky. We know that wherever light will travel the waves will carry sound. They will carry sound at the same rate that light travels, and if it should happen that other parts of the universe are inhabited by mortals or by immortals, we have a conductor that is joining us up to the place where they are. And we have demonstrated that that conductor will transmit speech.

"I was at a dinner in New York recently and we had a wireless telegraph working from the Arlington tower. All the diners heard what was being said in Washington. Then, coming out of space, the strains

of 'The Star-Spangled Banner' enveloped us. That music went all over the earth, to China, to India, to Australia. More than that, it went off into space. It was propagated at the velocity of light, and in forty-five years anyone who may be on the North Star will hear 'The Star-Spangled Banner.' Three thousand years from now, if anyone happens to be in the vicinity of some star of the fifteenth magnitude he will be thrilled with that grand, old, patriotic tune; and so it will go on resounding through the ages to the utmost limits of unfathomable space.

"Maybe we shall hear some day, coming out of the great ether, a voice proclaiming 'Peace on earth, good will toward men.' Now do you understand what I meant when I said that it is impossible to think of this thing in terms of business?"

A BUNCH OF BRAINS, NERVE AND HEART.

The short, wiry man in front of me was a bunch of brains, nerve and heart. His black, wonderfully luminous eyes, the taut face, told to how high a pitch he was keyed up. He just radiated energy, but withal, there was something very modest and very human about him. His mind, which will grapple with the most intricate detail of mechanical construction just as readily as with the infinite problems of the great beyond, seeks relaxation in researches on the early history of the state of Maine, in delving into Japanese history, art and religion, in the quiet enjoyment of the adventures of Mr. Homesweethome. In the prophet and the seer, in the wizard of the telephone, the young operator who could visualize talking with Chicago still lives. He has all the enthusiasm, all the self-confidence, and, above all, the generosity of youth. He went on:

"What has been done is not the accomplishment of any one man. There is enough glory in it for everybody in the whole Bell system. I have a very large staff of engineers assisting me and working under my direction, and we have worked on these problems for a great many years; so that whatever I had to do with it must be considered as the work of the director of the engineers, the chief of the engineers, if you will; but, after all, as that of only one of the men who participated in the work.

HOW FRANCE HELPED THE GREAT WORK.

"In wireless telephony we owe a great debt to the government of the United States and to the French government, and without their co-operation we could not have transmitted speech across the Atlantic. The Navy Department lent us the use of their towers all over the world and helped us in every way, and with the marvelous courtesy that only they can show, the French allowed us to experiment with the Eiffel Tower in the midst of this terrible war. At the time when we actually succeeded in speaking to Europe the great battle in the Champagne was being fought, and in spite of that, at a moment when so much depended upon their communications, the French actually shut down the Eiffel Tower and other towns in the neighborhood from working, so that we could carry on the first trans-Atlantic conversation. They helped us in the same spirit in which Lafayette and Rochambeau and all the others came over from France to help us at the time of the Revolution."

"But why did they have to shut down their wireless plants?" I asked. Mr. Carty said:

"The problem of wireless telephony is this—that the ether is a universal conductor and must be used in common by all who wish to employ this agency of communication. It is a single wire. Fancy trying to send all the telephone and telegraph messages of the world over a single wire. The multiplicity and confusion of simultaneous communication are obvious, but, on the other hand, anybody can send up a cry of distress, a cry for help, and it will reach all mankind wherever they be located on this earth or in space.

"There is not the faintest danger that the wireless telephone will supersede or even hamper the growth of the existing system. The function of the wireless telephone is not to do away with the use of wires, but to be employed in situations where wires are not available or feasible, as between ship and ship, or ship and shore, and across large bodies of water.

"The wireless telephone will never be competitive with the ordinary telephone; it can never be substituted for it. Just as the telephone itself can never be substituted for the telegraph instrument, because each has its uses. That is a very important thing to remember. The long distance telephone is not competitive with telegraphy but has a distinct field of its own, and the telephone system is supplementary to and not competitive with the telegraph system. In the same way, the wireless telephone is supplementary to and not competitive with the ordinary telephone.

HIGH IDEALS OF PUBLIC SERVICE.

"Our art—the art of electrical voice extension—is not a business. It is a service, and a very high kind of service. The wire system we are building up is only a part of a great, wonderful world system of intercommunication which is to be. The object of every man and woman connected with the Bell has been universal service. That is that every person, firm or company in the United States that ought to have a telephone shall be provided with one, and that any person so provided, wherever he may be located, can within a reasonable time be connected to the telephone of any other subscriber and talk satisfactorily.

"When we successfully talked across the continent, at what is practically its widest part, it really meant that we had accomplished universal service as far as the United States is concerned. Now each one of us feels that he or she is part of a development so grand and so majestic that we cannot grasp its import. But it has an ultimate big purpose. Just think of what its results are going to be, what the results have been in the past and what they are going to be in the future.

"The telephone has been the chief factor in our American progress, in the development of our American civilization, because it has given us better intercommunication than any other nation has ever enjoyed. That means it has brought all our people closer together than any similar number of people have ever been brought together in the history of the world. It is not distance that creates difference of speech, differences of ideas and habits of thought. It is lack of communication. There are places in this world where races, less than 100 miles apart but separated by mountain ranges, are totally different from each other. That is simply because they have no intercommunication.

TRUE MISSION OF THE TELEPHONE.

"Now, there can be no doubt whatever that some day we shall establish telephone communication with every part of the known world. That is the work we are engaged on now. What will be the effect of all this? Where people do not freely communicate with each other they do not understand each other. There is misunderstanding, there is suspicion, there is jealousy, there is war. But when people can freely communicate with each other they are drawn together and

a condition is created where all interests are common to all people.

"The world-telephone will make a common language a necessity. That does not mean that all languages except one will disappear, but there will be one language which all the world will understand and use for communication. It will be the language that we Americans talk. And with the common understanding of language will come a free exchange of thought and of ideas and a common brotherhood of man. Frontiers will gradually disappear, and we shall evolve into one great family of mankind. That, I believe, is the true mission of the telephone.

"Soon after we had dedicated the transcontinental line the sound of the Liberty Bell, which had not been heard since it tolled for the death of Chief Justice Marshall, was transmitted by telephone to San Francisco, where it was plainly heard by all those there assembled. It has often been pointed out that the words of the tenth verse of the twenty-fifth chapter of Leviticus, added when the bell was recast in 1753, were peculiarly applicable to the part it played in 1776. But the words were still more prophetic. The old bell had been silent for nearly eighty years and it was thought would remain silent forever, but by the use of the telephone a gentle tap, which could be heard through the air only a few feet away, was enough to transmit the tones of the historic relic all the way across the United States. Thus, by the aid of telephone the Liberty Bell was enabled literally to fulfill its destiny and to 'proclaim liberty throughout the land, unto all the inhabitants thereof.'

"What we ought all to be specially proud of is the fact that these achievements are the product of American institutions and reflect the genius of our people. The story of the telephone, the story of its development, is the story of our own country, a story exclusively of American enterprise and of American progress. All the most powerful governments of Europe have tried their best to develop and operate telephone systems, and with what results? Great contributions to the art have not been made by any of them.

"Americans have given a new voice to mankind, have created and perfected an electrical system of communication for the advancement of civilization. Americans have extended without limit the carrying power of the human voice, eliminating barriers to speech, binding together our own people and now reaching out with the great aim of some day bringing all the people of all the nations of the earth into a common brotherhood.

"It is hard to realize that all this has been done in the narrow space of forty years, and yet it is so. It was on the 10th of March, 1876, that the telephone was born. Over a wire extending between two rooms on the top floor of a building in Boston, Alexander Graham Bell spoke to his associate, Thomas A. Watson, saying: 'Mr. Watson, please come here, I want you.' The wire was only 100 feet long, and yet the voice heard in the crude receiver was so faint as to be scarcely audible. That piece of wire is still in existence. It is worth many times its weight in gold.

"When we succeeded in connecting up the Atlantic and Pacific I interpolated that little piece of wire, less than 100 feet long, into the great line stretched for 3,600 miles. Then I had Mr. Bell come to New York and Mr. Watson go to San Francisco, and when they talked to each other that old piece of wire, the first to vibrate to the tone of the human voice, was in the circuit and once again carried their words, this time clearly and distinctly across the continent 190,000 times its length.

"That is the spirit in which we work. Imagination and co-operation, initiative and discipline, patience and skill, courage and foresight, these are the things that have carried us so far, and the credit belongs to no one man. The first thing that founders of the Bell system did was to organize an experiment and research department, and from that small beginning there has been developed the present engineering, experimental and research department under my charge. From two men in 1876 the staff has grown to more than 600 engineers and scientists, graduates of nearly 100 American colleges and universities. This only includes the men devoted to experimental and research work and does not include the very much larger body of engineers engaged in manufacturing and practical field work.

"A good idea may spring up in the mind of a man anywhere, but as applied to such a complex entity as a universal telephone system no individual unaided can bring the idea to a successful conclusion. That is why a comprehensive and effective engineering and scientific and development organization such as this is necessary, and often years of expensive work are required before the idea can be brought to full fruition and a complete usefulness for the service of the public.

"All that means constant change and betterment, constant development and constant expenditure of vast sums of money. The relentless making way of the old for the new, the never-ending substitution of something better for what only yesterday we thought was well-nigh perfect, is the price that progress exacts from those who would keep abreast and ahead of the times.

"And so it is that the efficiency of the electrical engineer is not judged so much by his works that endure as it is by the size of the scrap heap he creates. The size of the scrap heap is the measure of progress, and so it is that from 1876 on improvement has followed improvement with bewildering rapidity. In forty years we have invented, used and thrown away fifty-three styles of telephone receivers and seventy-three styles of telephone transmitters. The average age of all the 12,000,000 telephones in use today throughout the United States is less than sixty months."

Telephones on Lehigh Tugs

Tugs engaged in New York harbor service for the Lehigh Valley Railroad will soon be equipped with telephones. When a tug touches at one of the company's piers, without leaving his place in the pilot house the tug captain will be able to call up the tug dispatcher at Jersey City on a private wire leased by the railroad from the New York Telephone company, report his arrival and learn what he is to do next. To make this possible, cut-in boxes are now being placed on the ends of each of the Lehigh Valley piers in New York, Brooklyn, Jersey City and the Bronx. The tugs also are being equipped with the necessary apparatus. When a tug touches a pier end, a deckhand will be ready to jump ashore and couple up the telephone. The result will not only prove a big time saver, it is believed, but the railroad management expects the idea will greatly increase the efficiency of the tugs and barges.

A race horse could not do any work worth mentioning. The man who sits quietly at his desk and lets the office boy do the trotting accomplishes more than the man who spends half his time tearing around the office with a bunch of papers.

European Telephone Development

Translations from the Foreign Press and Communications from European Engineers

BY FRED W. SCHOLZ

THE last issue of TELEPHONE ENGINEER described the testing equipment of the semi-automatic telephone exchange at Angers, and the present issue will start the account of the details of the semi-automatic system at that city in France, which was started before the war and put in operation during the latter. At the present time 1400 subscribers are connected to the switchboard which has a capacity for 3000 lines and the entire exchange system has been planned for an ultimate capacity of 20,000 subscribers. The complete circuit of the entire system is shown in Plate I.

A. The subscriber lifts his receiver: The two branches of line *A* and *B*, being connected to the subscriber's telephone set, the current from the 24-volt battery passes across the two coils of the 1000-ohm line relay *LR* and across the two back contacts of the cut-off relay *COR*. The armature of the relay *LR* is attracted, which results in closing the circuit of a battery of 48 volts across the two starting relays *CR* and the two resistances of 200 and 600 ohms in series with ground.

The relays *CR* in attracting their armatures, close the circuit of relay *SCR*, which in its turn closes the circuit of the coupling magnets of the primary or first selectors *P* by way of the lower contact *G*, the back contact of the testing relay LT_2R, the upper contact of *B*, the common center where the first selectors concentrate, corresponding to the subscriber's group calling the number, the two contacts in parallel with relay *SCR* and ground. All the first selectors of this group are busy in search of the line calling. One of these first selectors meets the first line and brings about a connection with the contacts *ABCD* of this line. At this moment the current which passes over the relay *CR* branches off and divides over *D*, the corresponding brush or wiper arm, the spring *C* of the connector, the 800-ohm winding of the testing relay *LTR*, the spring *L* and ground. The testing relay LT_1R attracts its armature in such a way, that the current passes across the 12-ohm winding of this relay and the 20-ohm winding of the testing relay LT_2R and from there over the lower contact of *D* to ground.

It is important to note that the relay LT_2R works only if the wiper arms of the selector switch are opposite the contacts of the calling line. If it is otherwise, the interrupter of the first selector *INT* would prevent this, by short circuiting it with ground over the upper contact of *M*. The shunt formed by the two windings of 12 ohms and 20 ohms of the two test relays is supposed to make the calling line "busy" for all the other selector switches, the relays LT_1R being constructed, so that they do not attract their armatures, when thus shunted. In order to make a double connection impossible, the relays LT_1R are governed in such a way, that if by chance, two of them were to act at the same time, their armatures would fall back, which would let the two corresponding primary selectors rotate on, while another selector of the same group would stop at the calling line.

The working of relay LT_2R results in breaking the current circuit of the starting magnet *P* and in closing the circuit of the block relay *H*, as follows: Battery of 48 volts, lower contact of spring *F*, working contact of relay LT_2R, upper contact of spring *B*, and ground with the starting relay *SCR*. The block contact starts and stops the brushes (wiper arm) of the selector switch at the contacts of the calling line. The relay LT_2R also closes the circuit of the connector *R* in parallel with the block magnet *H*: the connector passes to position *3* where it waits for a second selector. In passing by position *2*, the connector closes the circuit of a 48-volt battery across the cut-off relay *COR*, the contact and wiper arm contacts *G*, the upper contact of *I*, the 45-ohm and 12-ohm windings of LT_1R, the lower contact of *D* and ground. The cut-off relay *COR* will now operate the relay if line *LR* is not attracted any more, the starting relay *CR* comes back to the rest position. The armatures of relays *CR* in falling back, open the circuit of relay *SCR;* the latter interrupts the other selectors, which are connected and have been rotating to seek the calling line. The current passing over the cut-off relays will keep the two testing relays LT_2R and LT_1R attracted, after the circuit of relays *CR* has been opened.

The telephone call counting apparatus which is in parallel with the cut-off relay does not work, for it is arranged so that it will work only with double the voltage of the battery.

It should be stated here that the starting relays *CR* and *SCR* are constructed so that they begin their operation anew, as soon as one of the line relays in a group has been started. They will then influence some of the starting magnets *P* of the first selectors, whose connectors *R* are in position *1*. When the connector *R* is in position *3*, the circuit of the 48-volt battery is closed by way of the windings of the line relays of a group of selectors of the first group *GLR*, the lower contact of *N*, the guard relay *GR*, the upper contact of spring *F* of the connector of the first selector switch, the working contact of the testing relay LT_2R, the lower contact of *B* and ground, provided at least one secondary contact arm is free. If these last contacts are all busy, the connectors of the first selector *R2*, not being any more in position *1*, as will be seen later, will have no current coming from the lower springs *N*. Consequently the relay *GR* will not be energized. The guard lamp or off-normal lamp *GL* will then light up, showing that all the secondary selector switches are busy, while, if there are one or more free secondary selectors, the guard relay *GR* will not operate, and the guard lamp *GL* will not light.

Each relay *GLR* in working, closes the current circuit of the battery by way of the release magnet of the secondary selector *PF*, the upper contact of *C*, the back contact of testing relay GT_2R, the working contact of relay *GLR* and ground. The release magnets of the second free selector arms of a bank of contacts will begin to work and these contact wipers will rotate to search for a primary selector which is already connected to the line of the calling subscriber.

When the first selector switch has been found by one of the second selectors, the circuit of the battery is closed by the upper contact of spring *H* of the first selector, the 200-ohm resistance, the contact bank and wiper arm of the second selector, the upper contact of

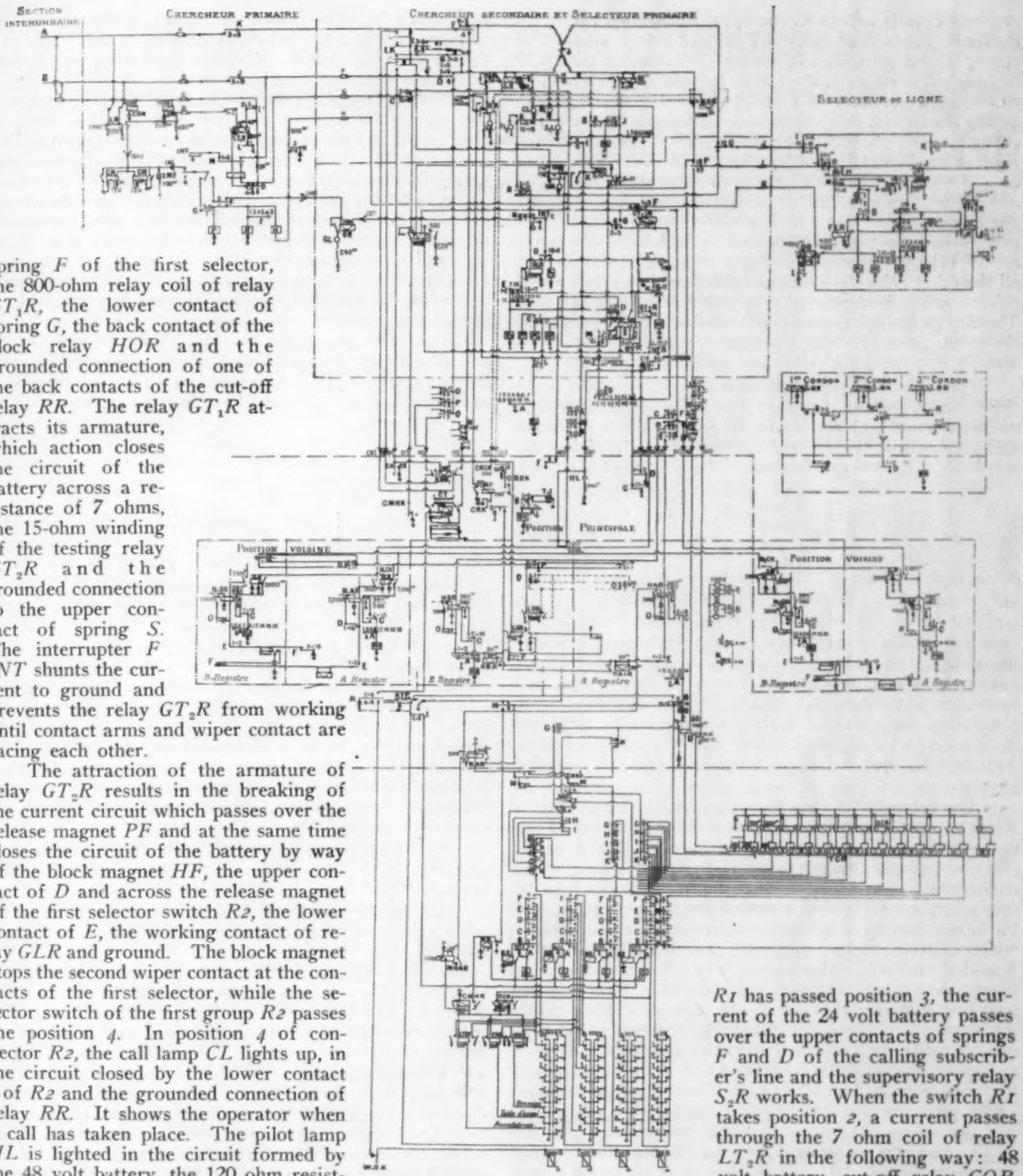


Plate I. Wiring Diagram and Circuits for Angers Semi-Automatic System.

spring *F* of the first selector, the 800-ohm relay coil of relay GT_1R, the lower contact of spring *G*, the back contact of the block relay *HOR* and the grounded connection of one of the back contacts of the cut-off relay *RR*. The relay GT_1R attracts its armature, which action closes the circuit of the battery across a resistance of 7 ohms, the 15-ohm winding of the testing relay GT_2R and the grounded connection to the upper contact of spring *S*. The interrupter *F INT* shunts the current to ground and prevents the relay GT_2R from working until contact arms and wiper contact are facing each other.

The attraction of the armature of relay GT_2R results in the breaking of the current circuit which passes over the release magnet *PF* and at the same time closes the circuit of the battery by way of the block magnet *HF*, the upper contact of *D* and across the release magnet of the first selector switch *R2*, the lower contact of *E*, the working contact of relay *GLR* and ground. The block magnet stops the second wiper contact at the contacts of the first selector, while the selector switch of the first group *R2* passes the position *4*. In position *4* of connector *R2*, the call lamp *CL* lights up, in the circuit closed by the lower contact *I* of *R2* and the grounded connection of relay *RR*. It shows the operator when a call has taken place. The pilot lamp *HL* is lighted in the circuit formed by the 48 volt battery, the 120 ohm resistance, the bell relay *NA*, the contact *J* of *R2* and the ground connection *D* of *RH*.

3. When *R2* leaves position *1*, it opens the circuit of relays *GLR* and *GR* at the lower contact of *N;* the armature of the guard relay *GR* falls back, but the relay *GLR* remains attracted by the upper contact *B* (first selector), the lower contact *M* (second selector), the supervisory lamp S_2L and the 24 volt battery. The resistance of this circuit does not let the lamp S_2L light up.

When the mechanism of the second selector switch *R1* has passed position *3*, the current of the 24 volt battery passes over the upper contacts of springs *F* and *D* of the calling subscriber's line and the supervisory relay S_2R works. When the switch *R1* takes position *2*, a current passes through the 7 ohm coil of relay LT_2R in the following way: 48 volt battery, cut-off relay *COR*, contacts and wiper *C* of the first selector, upper contact of *I*, 45 and 12 ohm windings of relay LT_1R, contact bank and arm of the second selector, upper contact of spring *C*, back contact of relay *HOR* and back contact and grounding of relay *RR*. This current neutralizes and balances the effect of the current passing in the windings of relay LT_2R_1, for the 7 ohm winding is wound differently from the 20 ohm winding just mentioned. The armature of relay LT_2R in falling back closes the circuit of the bat-

tery of 48 volts across *R*, the upper contact of spring *G*, the back contact of relay LT_2R, the lower contact of spring *B* and ground. When the first selector switch *R* has passed position *4*, the circuit of relay LT_1R is open to the upper contact of *I* and the current which passes across the cut-off relay finds a new road across the upper contact of *D*, the 20 ohm winding of LT_2R, the lower contact of *E*, the 7 ohm winding of LT_2R, the contact arm and contact banks of the second selector, etc. The armature of relay L_2TR is attracted anew, which opens the circuit of *R*. The first selector switch will stop in this position, until the connection is broken by the operator. When *R* passes position *3*, it opens the circuit of all the other relays *GR* and *GRL* belonging to the second selectors, which were used to search for the first selector. The armatures of these relays fall back, the circuits of the release magnets *PF* are opened to the contact of relays *GLR* and all the secondary relays stop.

From the lengthy description given, it might seem that a considerable space of time elapses between the moment when the second contact wipers begin to rotate and the moment when these wipers stop at the right contact bank. In reality this time is about 1/10 of a second.

B. The operator presses on her keys: To get a clear idea of the working of this system, let us assume that the subscriber asks for 1875. The operator presses down the keys in the order 1, 8, 7, 5. The keys remain pressed down and are held by their electromagnets, which latter are connected to the 48 volt battery by contact *N* of the register *RHA*. A release key *WOK* is provided in this circuit so that the operator can release the keys she has pressed, if she makes an error, provided all four keys have not yet been depressed. When the keys are pressed down, the battery circuit is closed by way of the relays, controlling the keys, *KTR*, the contact *1* of the 1000-key *K*, the contact *8* of the 100-key *K*, the contact *7* of the digit key *K*, the contact *5* of the unit key *UK* and the ground.

The relay *KTR* attracts its armature, which rotates *RHA* till it reaches position *8*, by a circuit comprising the upper contact *B*, the working contact *KTR* and earth. *RHA* in passing through position *7*, connects the ground connection to the selector switch R_1 in the circuit R_1, the upper contact of *I* of *R*, the lower contact *N* of R_3 and the upper contact *L* of *RHA*. *R1* passes to position *6*, which disconnects the operator's position at the contacts *D* and *F* and relays the lamp *RL* to the interrupter FL_1 by way of contact *L;* this lamp flashes. At the same time a circuit is closed across the relay *MR*, the recorders *R1000*, *R100*, *R10*, *RU*, the back contracts of the cut-off relays of the recorders *NR*, the lower contact of *I* and the contacts of the four keys 1, 8, 7, 5, all connected in series with earth. Relay *MR* attracts its armature, which prevents *RHA* from going further than position *8*. The recorders *R1000*....., which are in any position whatever, begin to rotate. As soon as they arrive at the respective positions 1, 8, 7, 5, they close a circuit across each cut-off relay *NR*, the springs 1, 8, 7, 5, the recorder contacts, the push buttons or operator's keys and ground. The relays *NR* work in such a way that they stop at the positions corresponding to the number buttons pressed down by the operator. The armature of relay *MR* falls back and grounds *RHA* across the lower contact of *M*. *RHA* passes to position *12*. The lower contact *R* of *RGA* being closed, the *100* lamp of the 100-group lights, indicating that the counter goes on to the other digits. The keys of the set are released, for their circuit is open for contact *N*. The release of the keys opens the circuit of relays *KTR* and *NR* whose armatures fall back. In this position the counter *A* can begin to count the number of current impulses sent out.

Before describing the operation of the circuit passed through by the counter it is necessary to show how the first group selector switches are connected to the line selectors. Every horizontal bank of a selector of the first group corresponds to a certain group of 200 lines connected to a group of selectors or connectors. As there are 10 horizontal banks of the first group selectors, there are then 10 groups of selectors of 200 lines each, which gives a capacity for 2,000 connections. There are 22 contacts in each horizontal bank of a group of selectors of the first selectors each connected to a line selector or connector of the same group.

The following table shows how the first selectors of a first group correspond to the line selectors or connectors and how the rotation of the recorder is arranged so as to allow the calling of lines between 1800 and 1999.

First Selector.	*Connectors.*	*Lines*	*Contact Banks*	*Even Hundreds*	*Odd Hundreds*
1 range	1	0 — 199	1	1 800...1 809	1 900...1 909
3 —	2	200 — 399	2	1 810...1 819	1 910...1 919
5 —	3	400 — 599	3	1 820...1 829	1 920...1 929
7 —	4	600 — 799	4	1 830...1 839	1 930...1 939
9 —	5	800 — 999	5	1 840...1 849	1 940...1 949
2 —	6	1 000 — 1 199	6	1 850...1 859	1 950...1 959
4 —	7	1 200 — 1 399	7	1 860...1 869	1 960...1 969
6 —	8	1 400 — 1 599	8	1 870...1 879	1 970...1 979
8 —	9	1 600 — 1 799	9	1 880...1 889	1 980...1 989
0 —	10	1 800 — 1 999	10	1 890...1 899	1 990...1 999

One can see from the above table that in choosing one bank of a selector in the first group one is in the presence of the hundred digits, without the need of a thousand digit. Each line selector is arranged so as to be divided into even and odd hundreds. If the line chosen falls within the even hundreds, a certain number of impulses will be sent out, corresponding to the number of the hundred-group indicated on the keyboard. If the number is among the odd hundreds, the connection of the recorder to the counter relay is such that 10 more impulses are counted than if an even hundred is wanted. To make a connection equal to the number 1875 there are needed three selections:

1. A 10th bank of selectors of the first group corresponding to the 10th group of the line selectors or connectors. This latter takes care of the hundreds.

2. The 8th horizontal bank of the line connectors of a line selector of the 10th group. This takes care of the 10-digits.

3. The 6th contact of an even hundred of the line selectors. This looks after the unit digits. If the number called had been 1975, the third selection would have been in the odd hundreds, that is, at the 16th contact of the 8th bank.

In turning again to our circuit, *R2* being in position *6* and *RHA* in position *12*, the fundamental circuit for the transmission of current impulses runs as follows: battery, line relay of the selector of the first group *GLR*, lower contact *B* of *R2*, lower contact *H* of *R3*, selecting relay *SR*, back contact of the counter relay *TCR*, lower contact *D* of *RHA* and ground. The two relays *GLR* and *SR* are energized.

The attraction of the armature *SR* connects the counter circuit to earth by way of the working contact, the lower contact *G* of *RHA*, contact *8* of *G*, contact *1* of *K*, the back contact *TCR*, the winding of *SCR* and the battery. The relay *SCR-9* is the 10th relay corresponding to the 10th horizontal bank of the selectors of the first group. The attraction of the armature of relay *SCR* closes the circuit of the battery across *SCR-9*, *TCR-9*.

the working contact of *SCR-9* and the contacts *J* and *K* of *RHA*. The relay *TCR-9* is not attracted, as it is short circuited by the earth, which latter is connected to the counter circuit at contact *SR*. It is energized only when *SR* returns to the rest position. The attraction of the armature of *GLR* closes the circuit of the battery by way of *R2*, the lower contact of *D* of *R2*, the back contact GT_2R, the working contact *GLR* and ground.

R2 passes to position *7:* In this position the electromagnet of the wiper arm *P2* is operated by the current passing over the lower contact *O* and the working contact *GLR*. The contact shaft begins to turn. At each step the interrupter *INT.2* connects the fundamental circuit to ground by way of the upper contact *N* of *R2*. The relay *SR* returns to the rest position, the relay *TCR-9* is worked and attracts its armature. This changes the grounded connection from *SR* to the back contact of relay *TCR*-8 and to the winding of *SCR*-8, which attracts its armature. This operation closes the circuit of the battery by way of *TCR*-8 and makes this relay operate, when relay *SR* is again short circuited by the second grounding of the interrupter *INT.2*. In this way, at each short circuiting of *SR* a pair of relay counters is eliminated and consequently, when 10 steps have been counted by *INT.2*, 10 current impulses have sent out and 10 pairs of relay counters eliminated. When the last relays *TCR*-0 (400 and 800 ohms) have been energized by the last ground terminal connection of *INT.2*, the circuit is found open at the back contact of relay *TCR*-0 of 400 ohms, and the relays *SR* and *GLR* return to their back position. In falling back, the armature of *GLR* closes the circuit of the battery by way of *R2*, the upper contact *E* and ground.

R2 now passes to the 8th position and then to the 10th position, where it closes the circuit of battery by way of the line relay of the selector of line *FLR*, the upper contact of *H*, the contact bank and contact *J*, the lower contact *P* of *R2*, the lower contact *K* of *R3*, the contact *D* of *RHA*, the back contact *TCR*-0, the relay *SR*, the lower contact *H* of *R3*, the lower contact *Q* of *R2*, the contact bank and contacts *I*, the upper contact *I* of the line connector and earth. Relay *SR* attracts its armature, which grounds the relay *SCR-7* by way of lower contact *H* of *RHA*, contact *M* of R100, lower contact *J* of R10, back contact of relay *TCR-7* and then relay *SCR-7* attracts its armature.

If the line asked for is free, the current from the battery passing across the cut-off relay *COR* and the relay FT_1R attracts the armature of this last relay. A portion of the current passes over its 50 ohm winding by way of the relay FT_2R and reaches earth by the right contact of relay *QR*. The relay FT_2R attracts its armature; when the wiper contact has reached position 10 a current closes at *R* by way of the lower contact *E*, the working contact of FT_2R and the grounded connection of relay *FLR*. *R* passes the position *11* and stops at position *12*. At this position the calling current is sent across the relay *RGR*, the contact *J*, the contact bank and wiper contact *B*, the line and the subscriber's set asked for, with the return circuit by way of the wiper and the contact bank *A*, the contact *K* and ground.

When *R* passes position *11*, the circuit across the supervisory relay S_2R is open to the contacts *C* and *I* of the line selectors. This relay lets its armature fall away, which closes the circuit across *R1*, the upper contact *B* and the grounding of relay S_2R. In the position *10* the control lamp *RL* lights up across the contact *K* and the ground terminals of S_2R, which indicates to the operator that the call is being made over the wire of the called subscriber. *R* finally being in position *11*, the current from the battery closes across *P2*, over the contact *B* and the ground connection of the interrupter *INT.2*, in such a way, that the selector contact shaft returns to its normal position. The positions of the various contacts are then: *R*=4; *R*1=10; *R2*=12; *final R*=12.

When the subscriber called removes his receiver, the relay *RGR* attracts its armature, which closes the circuit of the current from the battery across *end-R*, over the upper contact *E* and *final-R* passes position *13*. The lower contact of *J* is open, which causes the armature of *RGR* to fall off and, the upper contacts of *J* and *K* being closed, the line is under the effect of the current passing over the telephone repeater and over the supervisory relay S_2R. The latter attracts its armature, which grounds *R1* by way of contact *J* and *R1* passes to position 15. The two subscribers can now communicate.

When the two subscribers hang up their receivers, the supervisory relays S_1R and S_2R let their armatures fall away, which lights the supervisory lamps S_1L and S_2L. No other change takes place until the operator breaks the connection.

The operator, noting the supervisory lamps light up, presses down on her cut-off key or button *RK*. Current passes over the 500 ohm winding of the relay *RR*, the key *RK*, the lower contact *H* of *R1*, the back contacts of S_1R and of *HOR* and grounded connections of relay *RR*. This latter relay is blocked by its right winding of 500 ohms, by the contact *R* of *R2* and by its own right contact.

Current passes over *R2*, the working contact of *RR* and the upper contact of *M* to earth. *R2* passes to position 13. In this position LT_2R lets its armature fall away, which action closes the circuit of *R* of the first selector switch contact bank, the back contact of LT_2R, the lower contact *B* and earth. *R* returns to its normal position. *R2* in position 13 closes a circuit across *R1*, the lower contact *B* of *R1*, upper contact *K* of *R2*, upper back contact of *HOR* and earth. *R1* returns to its normal position. When *R* and *R1* return to their normal positions, they take the positions 5 and 16. When *R2* passes to position 16, it closes a circuit by way of *GLR*, the upper contact *B* of *R2* and the lower contact *M* of *R1*. *GLR* attracts its armature and *R2* passes to position 17. In this position a circuit is closed for *PG*, by way of back contact GT_2R and the working contact *GLR*. *PG* makes the selectors of group one turn till they reach the rest position. Here a circuit is closed across *HG* over the upper contact *H*, the normal contact of the interrupter *G*, the relay GT_2R and earth at contact *S*. GT_2R in attracting its armature opens the circuit *PG* so that *HG* keeps the selector of the first group in the rest position. At the same time a circuit is closed at *R2*., across the lower contact *E*, the working contacts GT_2R and *GLR* and earth. *R2* returns to position 18 and remains there until the operator uses her keys at the switchboard.

In this position *GLR* and *RR* are not energized. The circuit of the battery closes across *P2* and *R2*, the upper contact of *C* and *INT.2*, which makes *P2* return to the normal position. *R2* in the position 13 opens the circuit of *QR* at contact *G* of *R2*. The right armature of *QR* in falling away, grounds *end-R* by way of contact *D* and *end-R* takes position 15.

The contact wiper will turn and take its normal position, and in this case the contact is connected to earth by way of *INT.1*, which makes a current pass over the

relay *FLR*, the lower contact *M* and ground. The attraction of the armature of *FLR* will break the circuit of *P1* and closes a circuit over *R* and *H* by way of contact *C*. The electromagnet of *H* will stop the contact wiper arm in its normal rest position. The circuit of *FLR* is now open for *H* and *end-R* has returned to its normal position.

It should be noted that *R2* at position 13 liberates the contacts of the selector of the first group from all connections with the line selectors or connectors, so that this selector can be used again, even before the first selector has regained its normal position.

In studying the plate the following explanation of symbols will be found helpful: 1. the springs used in the switches and general apparatus are indicated by horizontal lines and by marks above and below these lines. The springs are marked by the letters *A, B, C....*

The numbers 1-18 placed with springs *B, C, D....* indicate the positions in which the contacts are closed. The numbers above the springs refer to the upper contacts, those below to the lower ones.

2. Numbers separated by a +, for example 8+18, shows that contact is established at all positions between 8 and 18. On the contrary numbers separated by point only, as 4.10, shows that contacts are made only at those points, and that in all other positions the springs are at rest.

3. The battery of 24 volts is indicated by a single element —|— That of 48 volts by two elements. =||=

4. The interrupters for lamps are marked by a circle with a cross in the center.

5. The lines marked with a small x show the connections to be put in, if the system should ever be changed to full automatic type.

6. Broken lines.....show the wires and apparatus to be installed when the system passes the 2,000 subscriber mark.

7. The various types of apparatus described under titles like: equipment for a subscriber; first selector switch; etc., are separated by dashes and dots.—*Annales des Telegraphes et Telephones.*

Long Distance Telephones for Canary Islands

The estimates of material needed for the construction of a long distance telephone system connecting Santa Cruz de Teneriffe, capital of the Canary Islands, with several smaller towns in Teneriffe Island have just been completed. The work will require more telephone construction material than any previous project in these islands.

The longest distance between talking points is figured at 150 kilometers (93.2 miles). The number of instruments expected to be brought into use for long distance work is 119. The projected telephone line will extend nearly due west from Santa Cruz de Teneriffe to the west coast, and then south toward Orotava, Icod, and other towns and villages. The actual construction will be done by the Spanish Government, department of telegraphs, under the direction of the Cabildo Insular de Teneriffe. There would seem to be an opportunity for American producers to furnish the bulk of supplies required.

The following estimate of material needed was obtained from the official supervising the project (the American equivalents of the metric units being: Kilo=2.2046 pounds, millimeter=0.03937 inch; meter =3.28083 feet, square millimeter=0.00155 square inch). Silicum-bronze telephone wire: 29,548 kilos of 3.5-millimeter wire (approximately No. 7 Brown & Sharpe gauge); 8,640 kilos of 2-millimeter wire (approximately No. 12 Brown & Sharpe gauge); 2,400 kilos of 1.5-millimeter wire (approximately No. 15 Brown & Sharpe gauge); 800 kilos of 5-millimeter wire (between Nos. 4 and 5 Brown & Sharpe gauge). The breaking strain of the wire should be tested to 45 kilos per square millimeter.

Porcelain insulators: 4,500 double-petticoat type, with deep groove, 108 to 112 millimeters high; 6,000, same type, 90 millimeters high; 5,000 insulators 20 millimeters high by 20 millimeters long; 2,000 insulators 15 millimeters high by 15 millimeters long; 1,000 insulators 10 millimeters high by 15 millimeters long; 100 porcelain insulating elbows 110 millimeters long; 100 porcelain elbows 120 millimeters long.

Galvanized iron brackets: 4,500 brackets 108 to to 112 millimeters high; 6,000 brackets 90 millimeters high. These galvanized brackets should be arranged to carry insulators and should be from rounded bar iron, having a screw end for timber, and should range from 10 to 20 millimeters in diameter, prices being submitted for various grades.

Round galvanized-iron pins for insulators are wanted, carrying two washers 70 millimeters apart, as follows: 3,000 pins of 10-millimeter diameter; 3,000 pins of 12-millimeter diameter.

Insulated copper wire: 145 kilos (equalling approximately 7,480 meters) of wire of 1.5 square millimeters cross section or about 1.4 millimeters in diameter (nearest Brown & Sharpe gauge No. 16). This wire should be insulated with pure rubber, cotton spiral, cotton braid, and weatherproofed with black varnish.

For terminal and house, equipments are wanted. 119 long-distance telephones, magneto call, having two receivers; 4 switchboards, carrying 25 drops for complete metallic circuits (these boards should be of the wall type); 1 switchboard of similar construction for 12 drops; 8 switchboards of similar construction for 8 drops; 300 large cells, covered, of the Leclanche type; 500 lightning arresters and fuse blocks combined.

Wooden telephone poles will be needed for carrying the wires.

The competition to be met is that of the Swedish manufacture. The equipment now in use is of Swedish make, and both the instruments and the line construction are modeled after Swedish ideas. However, much difficulty has been experienced of late in obtaining telephone material from Sweden, even for maintenance and repair work.

Estimates should be sent to the President of the Cabildo Insular de Teneriffe, or to Sr. Juan Ortoll Delmotte, Calle Castillo, Santa Cruz de Teneriffe.

Petitions for Merger

Representatives of the Federal Telephone & Telegraph company and the New York Telephone company are securing the signatures of the subscribers of both telephones in Hornell, New York, on petitions to be filed with the department of justice and the public service commission for permission to combine the two. Over 30 per cent of the subscribers have signed and an agreement has been reached whereby the holders of the Federal paper are to receive Bell stock in exchange. It will be at least a year, however, before the combine will be completed. Hornell is one of the principal towns in the state having two services at the present time.

The "Triangle Trust"

A Possibility of the Future That Demands Consideration

BY TERRY W. ALLEN

WHEN one tries to look into the future and depict conditions that are going to happen, it is much like shooting in the dark; for the very things that you cannot see, unforeseen forces, almost immediately will thrust themselves into your calculations and throw the whole thing out of line. And when the time comes that you have predicted, these unforeseen circumstances have changed the whole aspect of things, and your prediction becomes a fallacy.

There is always an uncertain element that can never be rightly placed, that can never be seen, that can never be calculated into any prophecy you may see fit to make.

In this present article, I am going to try to look into the future just a little way and set forth, if I can, my own ideas of what the American Telephone & Telegraph Company is striving to do.

At the outset, I wish to make myself perfectly clear. I do not know that the things that I say will come to pass; but I do believe that the tendency of the A. T. & T. Co. is in the direction that I shall point out. If it can accomplish this end, if it can put through the program that it has set its heart upon, it will be so much the worse for this country; and it will be a condition that the country, generally, would not stand for and would not allow, if it knew the trend of what this great corporation and its allied powers are striving for.

When a person speaks of trusts, the general idea in the minds of most men is that a trust has refused to treat with the party speaking, or that, having something the matter with his liver, he sees things in a distorted condition. In other words, if you speak against the trusts, it is because you have not been able to make peace with the trusts; and your position, generally, is assailed and people speak to you about the business in which you are engaged in somewhat this fashion: "Why don't you make a deal with the trust? Why don't you sell out to them if they want you to? If you can make money out of the proposition, why let principle govern your action? Take the gold that they offer you; it is just as good gold as anybody else would offer you, and if you do not take it, they will crush you anyway, they having the power and the money to do so."

In fact, this is the general line of talk that you hear on all sides; and especially in the telephone business is this remarkably true. I will say that in the past few years, I have heard this proposition not once, but a thousand times. I have heard men say that every man has his price, and that it is only a question of time until he can be reached.

So thoroughly permeated is the Independent telephone field with this kind of logic that it is especially discouraging to the man who believes in the principles of honesty, integrity and duty to principle, and he loses a certain amount of faith in the people with whom he is directly associated. He cannot help it for the reason that his principles of integrity are continually being battered down as the walls in ancient times were battered by a ram, and the continual surging, pulling and pushing against this position weakens his faith in his fellowmen.

That every man has his price may be true, but it is a whole lot harder to have to combat, even among your own organization, men whose price is so low and whose integrity of purpose is always on the market to the highest bidder. Consequently, when we look into the future—and the future is never very far away—if this kind of man is to govern and to determine the policies of the industry that Independent telephony represents, the end of that industry as an Independent industry, and as an integral part of the domestic economy of our country is soon to see its finish.

For argument's sake, I will call the trust that I intend to write about the "Triangle Trust." This trust is composed, to my mind, of three distinct parts: The American Telephone & Telegraph Company, the Western Electric Company and the Western Union Telegraph Company, as one of the legs of the triangle; the General Electric Company as another leg of the triangle; and the National Carbon Company as the third leg of the Triangle. In other words, the wire portion of the trust is trying to get control of the wire interests of the country, both from an operating and manufacturing standpoint. The General Electric Company is trying to get control of the electrical railway and power companies of the country, and the National Carbon Company is trying to get control of the battery business of the country.

Has it ever occurred to the average individual how closely these three great powers are allied? How the General Electric Company's plans are often confused with the Western Electric Company's plans, that they manufacture different things for each other's use, and that the battery business, the electrical business, the telephone business and the telegraph business are all working together? To my mind, this is the most gigantic co-operating corporation in the country, and allied together it is so strong as to be practically the dictator of the policies of the country in regard to the telephone, electrical and battery business.

If we will look into the future just a little way, if this power is extended much more, we can see that the whole of the electrical business, the whole of the telegraph business, the whole of the telephone business and the whole of the battery business will be under the control of a very small group of men, who are the principal owners in these four institutions, and it will be practically impossible to cut the Gordian knot unless the sword of justice is swung quickly, surely and firmly. And unless some constructive, some intelligent and some decisive action is taken in the very near future, the hold of this institution will be so great and its power so great that it cannot be cut apart.

I picked up at random one of the popular magazines of today. I find that all of these parts of the "Triangle Trust" are represented by national advertising, and in this way the public is being educated to put up with, to stand for and to allow this inter-working, inter-dependent and inter-associated group of trusts to become stronger and stronger each day. To allow it to continue means to sap the very vitality of American freedom and to crush the very principle of individual effort upon which this republic was founded.

The products of these concerns are good products. They build only first rate products. That cannot be ques-

tioned and to attack them upon the products built is unthinking and unreasonable. You cannot hope to defeat a matter of this kind by this means. The only hope lies not in attacking the products as made, but in attacking the policies, which, if continued, mean the enslavement of the American public to a greater extent than England was enslaved by the monopolies in the time of Queen Elizabeth. Therefore, the only method of reaching this drastic alliance of power is by prosecution through the anti-trust laws of the country, which are clear and explicit upon this very subject; and if the laws can be evoked by conscientious and determined counsel on the side of the people with the aid and assistance of the government, the remedy is sure and just.

I have been surprised in the telephone field to find the tentacles of the American Telephone & Telegraph Company entwined in the very heart of the Independent industry; and of men in whom I have had the greatest faith, as being representative of the Independent industry, I now have serious doubts about their honesty of purpose. And if in the telegraph field, the electric field and the battery field, the same condition exists as it does in the telephone field, the danger to the free institutions of the American republic is very great. The future domination of this country by a few men in charge of the great industries can lead only to one thing, and that one thing is revolution; not necessarily a bloody revolution like the French revolution, not necessarily like the American revolution, but, nevertheless, a revolution. The people of this country have ever abhorred slavery, and when they find themselves slaves, they will throw off the yoke just as our forefathers threw off the yoke of English tyranny, and just as in the future we will have to throw off the yoke of industrial tyranny. The laws are clear and the means are clear, but have we individuality enough to attack the problem?

Spokane Cancels Franchise

The Home telephone franchise, under which the telephone company in Spokane, Washington, is operating, was ordered canceled by the city council late in the afternoon of October 16. The resolution was passed unanimously.

Another resolution, ordering Corporation Counsel Geraghty to start suit immediately in the superior court to enforce the cancellation, also was passed unanimously.

Allegations by Attorney Frank T. Post for the Home Telephone Company that the company doesn't know the charges under which the city is seeking to cancel the telephone franchise, and the entering of an objection to the heading, were the initial moves of the company when the battle of the city against the company started.

The telephone company alleges that it has "one of the best telephone systems in the United States"; that it has always treated the public fairly, and that there is no reason for cancellation of its franchise.

After one passage between Geraghty and Post the former declared that "this franchise was drawn in the back room by a bunch of corporation lawyers of the telephone company for the benefit of the telephone company. Every obstacle possible was put in the way of its cancellation."

"It's a complete surprise to me," said Manager Hickman of the telephone company, when informed of the council's decision. "I'd no idea the company was confronted with anything of this kind.

"I won't make any statement until I've had time to study the case."

Asked if his company would fight the council over the order of annulment, Mr. Hickman said: "We shall certainly appear before the council and present our side of the case, but further than that I can't say anything."

If an agreement is not reached at the formal hearing, suit in the superior court will be started by the city immediately for the cancellation of the franchise.

The moves so far look as if the opposition was purely political to place the company in the hands of the municipal politicians as a municipal ownership company.

Telephone Companies Dodge Taxes?

Probably 100 telephone lines in North Dakota are paying no taxes. They fail to report to the state auditor. The penalty for failure to observe this rule is so severe that no one stands ready to enforce it, and there seems to be no way to remedy the situation unless the legislature sees fit to take action.

State Auditor Jorgenson's force is now engaged in completing the equalization of the state's 475 telephone companies, as decreed at the recent session of the state board. It is one of the many real big jobs which this department has to handle.

North Dakota has reason to be proud of its telephone development. In 1915 Mr. Jorgenson found that the rural telephone development service consisted of 16,241 miles of poles, 25,069 miles of iron wire, and 16,538 telephone instruments. The long distance service embodies 5,826 miles of poles, 11,926 miles of iron wire, and 13,763 miles of copper wire. There are 266 city exchanges, made up of 34,359 subscribers' exchanges. The assessed valuation of all telephone property in 1915 was $1,329,000.

The system in its entirety is made up of a sufficient number of poles to string a line around the equator, with enough wire to supply these poles with two complete circuits, and the total number of subscribers is in excess of 50,000.

Four hundred rural, co-operative, farmers' and social lines are now operating. The average assessment on the better class of rural line is $18 to $20 to the mile, while some range as low as $12 the mile. Among this class are to be found probably 115 companies which are not reporting as required by law, and against which no taxes are being levied.

New Wisconsin Telephone Company

The Northern Wisconsin Telephone and Telegraph Company is the title of a corporation recently formed in Oshkosh and whose articles of association were received at Oshkosh from the office of the secretary of state at Madison to be recorded in the office of Register of Deeds Hollands. It is stated that the purpose of the corporation, which is capitalized at $10,000, is the construction and management of telegraph and telephone lines and to "do everything necessary for the business of telephoning and telegraphing for its own benefit and for the public." The incorporators are C. H. Hartley and State Senator W. M. Bray, both of Oshkosh, and M. J. Wallrich, of Shawano.

When the Seller Lies Down on Contracts

The Buyer's Recourse When He Cannot Get His Goods

BY ELTON J. BUCKLEY

MY clients tell me that there has never been a time when contracts and arrangements for the sale of merchandise have been so much upset as they are now. The war conditions, the extraordinary demand for many products, the very high prices prevailing on a large number of commodities, and disorganized labor conditions have put a whole lot of people up in the air as to buying goods, or perhaps more accurately, to get the goods they have bought. A very large number of sellers, chiefly manufacturers, have deliberately lain down on their selling contracts, giving as their excuse the fact that they "find it impossible, under present conditions, to ship goods." Perhaps later, when conditions clear, etc., etc., etc.

I am receiving constant inquiries as to the rights of a buyer in a case like this. Take the following case, which came to my notice during the week: A very large buyer of a certain commodity, who wisely foresaw a coming scarcity in it, made a contract with a packer for enough to last him through the season. To induce the packer to make the contract under existing conditions, the buyer paid a premium over the current market.

The seller here has already lain down because he says he can't get some of his raw material. The buyer is buying what he has to get, in the open market, at an advanced price.

Or this case: A certain large manufacturer accepted a spot order for several thousand cases of a commodity at the then market price. Shipments were begun under this contract, when the market for the raw material which entered most largely into the contract, suddenly almost doubled in price. The manufacturer sent word to his buyers that market conditions were such that he could not ship. He was going to stop packing this particular article, he said, until the market became normal. This was of course a flat default in his contract, which called for periodical shipments. The buyer had to go out and cover his needs somewhere else. Always at an advanced price, for these situations never seem to arise unless the general market has advanced.

Where does the buyer come in in these cases? It is fine for a manufacturer who has contracted to deliver a certain quantity of a product at $3.50 a case to escape when the market goes to $5, merely by saying "I cannot ship," but what about the buyer, who has counted on the goods coming, and may even have sold them again? Has he any rights?

That depends on his contract. Many contracts for the sale and purchase of merchandise consist simply of two or three letters—the letter making the offer and the letter accepting it. Other contracts are more formal. They consist of a regular form signed by both parties. Still others are a memorandum which one party signs and the other simply accepts. And some contracts are verbal.

No matter what form the contract takes, the inquiry is of course as to wether the seller has put any clauses in it which would enable him to lie down in the middle of it. Contracts made by letter seldom contain any such provisions. Nor do contracts made verbally. The more formal kind may or may not. Each case stands on its own contract.

In the two cases above mentioned, and I may say in most cases, the contract contains nothing but a straight obligation by a seller to deliver so much goods on such and such terms, and an obligation by a buyer to accept them on those terms. Where it is that kind of a contract, the seller is bound hard and fast, and almost nothing that can happen to him will excuse him.

As one leading case puts it, "a contract is not invalid, nor is the promisor discharged, merely because it turns out to be difficult, unreasonable, dangerous, or burdensome. Thus one who sold goods to be delivered at a certain time cannot excuse himself by saying that he expected to buy the goods, but could not."

Unless the contract contains some provisions taking care of such contingencies, it makes no difference if a seller's plant is completely destroyed by fire. Or if his plant goes on strike and he is compelled to close. Or if his raw material or any other expense advances so as to become almost prohibitive. Or if he is quite unable to get raw material. Or even if, in a word, it has become, through no fault of his, physically impossible for him to fill his contract. None of these contingencies will excuse him or relieve him. He has bound himself to do a certain thing and he must do it or account to his buyer in damages. Every one of the thousands of buyers, who are now, according to information, unable to get shipments of goods they have contracted for, whether they be manufacturer, wholesaler or retailer, can collect their damages from their seller unless they have waived their rights in the contract.

What are those damages? They are the difference between the contract price and the market price at the time and place of delivery. That is, if a seller contracted to deliver at $3.50 per case and at the date when he finally lay down, the market price was $4.50, the buyer's measure of damages would be $1 per case for every case which the seller did not deliver.

(Copyright, August, 1916, by Elton J. Buckley.)

Use Telephone to Dispatch Trains

A telephone system costing approximately $19,200 will be installed next year on the Lake Shore division, between Green Bay and Milwaukee, Chicago & North-Western railroad, according to A. N. La Comb.

The new system will supersede the old method of dispatching trains by telegraph and is one feature of improvements costing $600,000.

An automatic block signal system has also been ordered installed from Manitowoc to Milwaukee, a distance of seventy-five miles. This will cost $225,000.

Examination for Electro-Mechanical Engineer

The United States Civil Service Commission announces an open competitive examination November 14 for expert electrical and mechanical aid, for men only. From the register of eligibles resulting from this examination certification will be made to fill a vacancy in this position at $12.48 per diem, in the Bureau of Yards and docks, Navy Department, Washington, D. C., and vacancies as they may occur in positions requiring similar qualifications.

Railway Telephone Development

Report of Special Committee No. 6 of the Association of Railway Telegraph Superintendents *

FOR a period of more than thirty years from the time of the invention of the telephone, in 1876, by Alexander Graham Bell, little use was made of the telephone for train dispatching. Although the progress for commercial purposes of this means of communication was very rapid it could claim but little advantage over the telegraph for train dispatching until a selective ringing system was perfected and a means provided whereby a large number of stations could be connected to one circuit without severe loss in transmission.

About 1907 the question of using the telephone for train dispatching, in place of the telegraph, was being given serious consideration by railroad officials and was a subject of discussion at the annual meeting of the Association of Railway Telegraph Superintendents in June of that year. Up to that time the use of the telephone by railroad was confined to local private branch exchange service, yard lines, a few exclusive railroad long distance circuits and commercial service through telephone companies' city exchanges and their long distance plant.

A limited use of the telephone was made by some railroads in dispatching trains, on short branch lines, the equipment consisting of ordinary telephone sets and signaling by means of code ringing. This method prohibited circuits of any great length and permitted only a limited number of stations on account of loss in transmission, use of code ringing and annoyance of almost continuous ringing of bells at all stations.

The successful use of the telephone for train dispatching seemed dependent upon a device that would provide a reliable and accurate means of calling separately the several stations on the line which would eliminate the ringing of bells at other stations and overcome loss in transmission to permit of circuits long enough to cover a dispatching division.

While it is a fact that a device of this character, known as a selector, was being developed, in connection with the telegraph, during the eighties, and was in actual operation as early as 1890, its use in connection with the telephone was not attempted until 1906-7, and during the latter year the C. B. & Q. and N. Y. C. & H. R. put into service the first train dispatching circuits equipped with selective ringing apparatus.

The expectations in this departure were fully realized for extensions of the system followed quickly and other railroads soon followed, their examples, so that at the present time more than 95,000 miles of railroads in the United States and Canada are being despatched by telephone.

SOME ADVANTAGES OF TELEPHONE TRAIN DISPATCHING.

The use of the telephone for train dispatching affords opportunities for the most efficient operation in that a larger volume of traffic can be handled with no increased dispatching force. This has been demonstrated on many lines during winter months or heavy traffic periods when additional train dispatching districts had to be created for no other reason than that the Morse circuits could not carry the load.

There seems to be practically no limit to the capacity of the telephone in this work for which there are several reasons.

1st. The efficiency of the operators has been greatly increased. Experience has shown that only a small per cent have any trouble whatever receiving or transmitting orders and messages with the telephone, while on the other hand many were poor Morse operators.

2nd. The loss in time of calling offices has been practically eliminated. While this may not seem to be of great importance yet close estimates show that at least one-sixth of the day was lost in this manner.

3rd. Siding telephones located in booths and pole boxes can be freely distributed along the division, thus giving employees access to dispatcher without going to stations, which facilitates handling of trains and eliminates loss of time.

4th. Portable sets are supplied to the crews of passenger, freight, wreck and work trains. These put the crews in immediate touch with the dispatcher from any point along the line.

ARRANGEMENT OF DISPATCHING CIRCUIT.

It might be well at this time to review briefly the make-up of a circuit. The line wire is the first important factor, as without a good line the system would be of little benefit. Ordinarily a pair of No. 9 B. & S. gauge copper wires are used, properly transposed to avoid interference from induction and other disturbances. Drops to offices, booths and pole boxes consist of twisted pair wire or twisted pair cable, and at all such points proper protection should be installed to guard equipment against lightning and possible high tension crosses.

Any cable either aerial, underground or submarine which from necessity forms a portion of the line should have the conductors made up in twisted pairs, and it is recommended that in every case where more than one-half mile of cable is used that the conductors be paper insulated. The use of rubber insulated cable in any but short lengths should be guarded against owing to the effect of the high capacity of such cable on telephone transmission.

At the dispatcher's office are located the dispatchers' telephone equipment, battery or motor generator sets and calling keys, together with the necessary signaling or calling apparatus, such as retardation coils, condensers, relays, etc., which equipment should for convenience be mounted in a cabinet generally known as the selector apparatus case. The way-station equipment should comprise selector, telephone apparatus, protectors and local battery.

MESSAGE CIRCUIT

After the installation of dispatchers' circuits, many railroads extended the service to cover handling of local messages and such circuit is really a duplication of the dispatchers' circuit. With the installation of message circuits there is also provided jack boxes and proper patching facilities at intervals over the division, which affords protection to dispatcher's circuit against failure.

BLOCK CIRCUIT

The next step was to provide a circuit for blocking of trains independent of dispatchers' and message circuit. This circuit is really a series of short lines, as between two block offices, which may be either metallic or grounded, preferably metallic, which will provide, by use

*Committee No. 6 consists of F. F. Riefel, Chairman, E. E. Dildine, C. S. Rhoads, G. K. Heyer, and L. M. Jones.

of proper equipment, a local Morse circuit. This circuit is so arranged that non-24-hour offices can cut through both telephone and telegraph to next open office, thereby providing continuous service.

PHANTOM SIMPLEX AND COMPOSITE

An additional circuit can be obtained by stringing dispatchers' and message circuits on adjacent pins, which when properly transposed will create what is known as a phantom. This in general can be connected to private branch exchanges and used for long distance division traffic. A series of phantom circuits may be connected together and with the aid of telephone repeaters conversation may be carried on over several divisions and thereby avoid stringing additional circuits of large gauge copper to handle long distance traffic.

A still further use may be made of the wire plant by simplexing and compositing the available circuits.

SELECTIVELY CONTROLLED SIGNALS

The telephone and selector apparatus has been applied to a comparatively new class of service, that of selectively controlled signals. Some four or five years ago there were installed by the Piedmont Traction Company selectively controlled semaphore sets connected to the regular dispatching line and during the past two years head-in and O. S. signals have been operated with very satisfactory results on the Michigan Central.

PRIVATE BRANCH EXCHANGES

With the increased use of the telephone by railroads there has been a rapidly increasing demand for p. b. x. service. The service can be satisfactorily given by both the manual and automatic systems. The local conditions will govern which method of operation is likely to be most efficient and economical.

LOOKING INTO THE FUTURE

It is felt that this paper would not be complete without looking ahead with the idea of foreseeing to a certain extent what the future telephone and telegraph developments will be in railway service.

1st. Unquestionably further improvements will be made in present types of apparatus and new types of apparatus will undoubtedly be developed to replace present types in order to provide in a more efficient and economical manner the same classes of service that are now being given.

2nd. Owing to the great destruction of open wire plants by storm, particularly during the winter months, and the resulting prostration of the service, it is believed that aerial and underground cable will be used to a much greater extent in the future than in the past. Owing to the improved methods of manufacture of paper insulated cable, telephone cables can be used in much longer sections than previously. This is particularly true in cases where telephone repeaters and loading coils can be made use of.

3rd. Printing Telegraph. The development of the printing telegraph has already reached the stage where there is no longer a question of its commercial value, and as the possibilities in connection with the use of this equipment are more fully realized, its application will be extended to various branches of the service and, in all probability, a great deal of the railroad business, which is now carried on between division headquarters and widely separated centers by mail, will be handled with the printing telegraph. This will unquestionably result in very greatly increasing the efficiency of the branches of the service making use of this equipment.

SELECTIVELY CONTROLLED SIGNALS

What has been done in selectively controlled signals, it is felt is only a mere beginning and it is believed that the future will bring forth a wide application of telephones and selectors to signal operation.

WIRELESS TELEPHONE AND TELEGRAPH

While for every-day operation of the train, message, private branch exchange and other branches of the railway telephone service it is felt that the wire system will continue to be the most important means of communication, there will undoubtedly develop a use for wireless telephone and telegraph service which will be of material advantage in conducting the business of a railroad system.

In summarizing, it is felt that the telephone will be used exclusively for all short line work and that the telegraph will be used only between division headquarters and widely separated points and that, further, in this latter service the printing telegraph will largely replace the manual telegraph of today.

CHAIRMAN E. C. KEENAN: I think you will admit the advantages of telephone train dispatching. We have discussed that at every meeting we have had for the last ten years. The arrangement of the circuit is described and pretty well defined, and as one that most of you have adopted.

M. B. OVERLY: We have our system pretty well covered with block telephones. We have had a number of different kinds, some grounded, some metallic. At the present time we are using metallic block telephone circuits almost exclusively, and when we get a little more work done, they will all be metallic. The principal advantage we find is, first, you get a first-class telephone circuit free from noise, and in the second place, you can usually get a metallic circuit without very much expense, by taking one telegraph wire alongside of your grounded block and making a metallic block telephone circuit and simplex it for your Morse. We use these metallic block circuits, also, as a patch for our dispatchers' circuit. The question was raised, in one of the other discussions, about cutting the dispatchers' circuit in at various points when it was patched. We overcome that difficulty by using a set of switches in the different intermediate offices which, when thrown over on the metallic block, you also throw the dispatchers' equipment over onto the metallic block. The block telephone circuits, of course, are iron, except in yards, and places of that sort. We find the patch of 20 miles of iron in a dispatcher's circuit as a rule, does not interfere with the sending, or with the transmission, unless the block telephone circuit is not in very good shape. You take the old iron circuits, transpose them, and keep them in good shape, and they make a first-class patch. If your main signaling battery is very close to the low margin, you will have some difficulty, but you will have to take care of that by having a happy medium. The telegraph that we get from that metallic block is a first-class telegraph circuit. We have some of them that are cut in at every office for telephone purposes; that is, calling from station to station, and also cut in at each one of these offices for local telegraph purposes. We have these made up in two different ways. Some of them simplexed and have retardation coils, and others have repeating coils. We find both of them work very satisfactorily, and I was rather surprised myself when the first ones were completed, to find that we didn't have any trouble from a retarding or leaky effect in the Morse. The Morse is a better circuit, than the ordinary straight Morse, and we don't have any more trouble; in fact, I don't think we have as much. Some people claim that we should have more trouble with the Morse on account of the two wires being subject to leaks, and various troubles, in the way of grounds and that sort of thing, but we find that a great many cases of trouble occur that do not affect the Morse. For instance, you can open alongside of these blocks in a great many places and it doesn't affect the Morse at all. We also find that where we have wire chiefs who are alert, when they get a ground on one side of these block circuits between two stations, they cut that side out by removing the fuses so that we have very little trouble in getting a first-class block or a first-class Morse circuit.

M. H. CLAPP: Are you still using any grounded block circuits, and if so, what results are you obtaining?

MR. OVERLY: Yes, we have some grounded circuits, but I think I said we are eliminating them as rapidly as we can. Not because we are having any particular difficulty with talking on these grounded circuits, but because we want to use them for patching purposes. We use a retardation coil on the special block circuits that eliminates the noise to a very large extent, but where you want to use one telephone for all purposes the

grounded block is not so satisfactory, because we have more noise. In some locations, we are unable to use the grounded block. For instance, where we have single phase trolleys paralleling us, we can not use the grounded block at such locations very well, because when a car moves in that section, your bell will keep on ringing until they get out of it.

F. H. Van Etten: I want to ask what instruments they use on a block circuit, whether a special set or the dispatchers' set?

J. J. Ross: They use the dispatchers' set. We have a line in service 180 miles long, over 20 offices in series with the Morse, and two other metallic circuits. Of course, we get away from the lightning discharges, and I think we get safer protection for our trainmen, as we use the trainmen in a good many cases. We have trainmen outfits, and we cut in the telephone circuits at these points rather than the dispatchers' circuits. In some cases we cut in both, but as a rule we cut in the block and not the dispatchers'. Both of them work satisfactorily. Of course, with the metallic, you get away from the lightning effect, and we use but one side.

J. P. Church: Can you use the simplex of a metallic telephone circuit as a second telephone circuit?

Mr. Overly: It depends entirely on what you use as a coil. We have a dispatchers' telephone circuit in the yards in Cleveland, six miles long, and we simplexed it, and use the simplex for a telephone circuit for the two yard masters. We dispatch trains over that metallic circuit, and the yard masters handle their business with each other over the grounded circuit, which is exactly the same thing as the grounded block that I was talking about a little while ago. The difficulty about that is, you must have an absolutely perfectly balanced coil. If you don't, you will get cross talk from one circuit to the other.

B. F. Thompson: We worked a circuit with coils between Washington and Baltimore. We had a simplexing coil on each end, and a grounded Morse circuit which was simplexed, and we had a composite telephone on that, and it worked.

J. F. Caskey: I am very much concerned in the question of inter-communication between division points and between executive offices and division points on long distance lines. Private branch exchanges you get from the telephone company under their contract, are not equal to the occasion for long distance work, and in order to get the matter straightened out, I had a study made of all the private branch exchanges on our road, some 20 in number, and I am arranging with the telephone people to equip them up to date with their very best devices, which will give us a minimum of choking effect from Buffalo to New York. I think it is a point that should be kept in mind. The ordinary private branch exchange you get from a telephone company is built for short haul work.

S. L. Van Akin: The American Telephone and Telegraph people have done very nicely for the New York Central on its long distance lines, and they are giving us their latest equipment, the very latest that their engineers can turn out, to handle our long distance lines and give us maximum service.

C. S. Rhoads: There are one or two items, that, as a member of this committee, I might say a word about. One is about the loud speaking telephone. Since this report was printed, a few days ago, it came to my attention that there seemed to be such a demand throughout the country for the loud speaking service, that I understand some of the best engineering telephone talent in the country is now at work trying to get up something that will be better than anything we have at this time. Another feature that came up is the development of telephone service. I will say that I think it is only seven years ago since we put up our first dispatching circuit. We asked to put it on a division 110 miles long with 47 miles of that distance paralleled with a 3,000 volt single phase current line, and a good many of the best informed people at that time thought that we would never get a dispatchers' circuit to work successfully paralleling that single phase line. At one or two points, we were within 11 feet of that circuit. Our circuit worked successfully, and I received a telegram today saying that our phantom just installed, paralleling that circuit, is working successfully. So, you see what is being accomplished in the way of telephone development.

Buffalo Merger Not to Go to Vote

The appellate court division of the state of New York by a vote of three to two, declared null and void an ordinance of the common council of Buffalo passed in 1904, which authorized the submission of questions of public policy to the electorate at a general election. The decision was rendered in a taxpayers' action brought by Moses C. Mills to restrain Daniel J. Sweeney, as city clerk of Buffalo, from publishing notice of a referendum of the question whether the New York Telephone Company and the Federal Telephone Company should merge, and whether the city of Buffalo should own and operate its own lighting system.

The matter came before Justice Cole in a special term of court in Buffalo. He held that the city clerk had no authority to submit to the voters the question of merging the telephone companies and granted an injunction restraining the city clerk from doing it. He ruled, however, that the city clerk might advertise a referendum of the proposition to establish a municipal lighting plant.

The appeal was argued before the appellate division, which now grants a temporary injunction restraining the city from publishing a notice of referendum of either of the questions. The city authorities are restrained from performing any official act toward the submitting of the questions to the voters at this election.

The appellate division holds that the common council of Buffalo had no authority to adopt an ordinance in 1904 authorizing the submission of not more than three questions of public policy to the electorate at a general election, and that the ordinance has not been validated by the new charter for the city.

Presiding Justice Kruse and Associate Justice Merrell dissent and vote for affirmance of Justice Cole's opinion. The court granted Corporation Counsel William C. Rann, of Buffalo, permission to appeal to the court of appeals, and the questions for review were certified.

Justice Cole decided that the proposal to merge the telephone companies was nugatory in that the council had already taken action on the proposed merger of the New York and Federal Telephone Companies and therefore it could not be submitted to the voters, but he upheld the ordinance and declared that the other question should be placed on the ballot for the election on November 7.

Councilman Hill of Buffalo said when interviewed:

"I feel that some comment on Justice Cole's decision regarding the telephone merger referendum reflect a misconception of the effect of that decision and of the action of this council.

"Justice Cole's decision has reference only to what is known as the public opinion ordinance, and does not interfere with a referendum upon petition at the coming election, which shall be decisive and binding upon the city under the provisions of section thirty-one of the charter. A referendum vote under the public opinion ordinance on the other hand would have no decisive or binding quality, and it was for this very reason that the council acted so as to allow abundant time (at least a month) for the people to secure through petition a prompt and decisive referendum under section thirty-one, which if had will finally dispose of the whole proposition."

Comptroller Cochrane reported to the Buffalo council that the New York Telephone company had filed its consent to the terms of the merger with the Federal Telephone & Telegraph company in compliance with the resolution adopted by the council, September 29. The consent was received and filed, along with that of the National Surety company.

The men who kick at working long hours are the ones who don't know what to do with the time on their hands after work.

The Acoustics of the Telephone

Paper Presented Before the Indiana Independent Telephone Association

BY RAY H. MANSON

Ray H. Manson

SOUND in the form of articulate speech is the most satisfactory of the many methods of conveying intelligence from one person to another. It is for this reason that the telephone has outstripped all other methods of transmitting over distances.

The transmission of sound, and especially speech, faithfully and without too much distortion, is the first mission of all telephone systems. The mechanical production of these sounds must be correct, and the getting of the sounds into direct contact with the telephone transmitter diaphragm must be done with intelligence. Otherwise the highest developed apparatus and circuits will fail to give a satisfactory reproduction at the distant end of the line.

It is not to be expected that the telephone will correct defects in the speech of the person talking or make amends for the deficiencies in hearing on the part of the listener. However, the incorrect use of the telephone, especially in the failure to have the speech actuate the diaphragm to best efficiency, can be corrected by educating the user.

Mere instructions to do a certain thing, without giving the full reason for them, usually fail to convince the average American. Thus our carefully worded and explicit instructions—"Place the lips close to the mouthpiece and speak in a firm tone of voice"—are seldom heeded. If such instructions are supplemented by a campaign of education, giving logical reasons for doing a thing, our American public will respond with more grace and the desired ends be attained.

As sound is the basis of telephonic transmission, we must know the subject intimately, to instruct others. And it behooves everyone connected with the industry, whether manager, troubleman, or inspector, to study the fundamentals of sound and their relation to the telephone.

Fundamentally sound is the result of a state of vibration, a fact that we know from experiment. It requires energy to cause a body to vibrate. But once these vibrations are produced, they are taken up readily by the air and transmitted to the human ear, which in turn vibrates and through the nerves and brain produces the sensation of sound.

In the production of sound, it is found that all vibrating bodies have a definite period of vibration, called a natural period, although we can make these bodies vibrate faster or slower than their natural periods by forcing them. These results can be likened to the swinging of a pendulum of a large clock—the time of making a complete swing or period depends on the length of the pendulum and for each length there is a definite period. Very little power is required to drive the clock pendulum at its natural period of vibration, yet the period can be changed by using sufficient power, such as grasping the pendulum by hand and swinging briskly at any desired rate.

The same can be said of the harmonic type of party line ringer. When the ringing current is in step with the natural period of vibration of the tapper rod, the bell will ring with a very small amount of actuating current. However, if the ringing current is of sufficient magnitude, it need not be of the same frequency as that of the ringer tapper rod, as the natural period will be overcome and the ringer be operated. In this case the vibrations are forced and the period is unnatural and the ringing irregular.

The diaphragms of transmitters and receivers have natural periods of vibration, but can be easily caused to vibrate at other rates. This tendency of diaphragms, or other mediums, to vibrate more readily at certain natural periods than for other periods, augments or magnifies some of the tones so as to impair the quality of the resulting sound. In the case of the telephone diaphragms, this tendency can be largely overcome by damping through pressure of a spring on the diaphragm center or through other similar means.

There are two kinds of sound, which are made known by the effect on the ear—noises and musical notes. If we consider a musical note as any sound which produces a particularly agreeable sensation to the ear, then a noise is sound lacking this function. Noises are the result of a complicated set of vibrations in which the body may not vibrate as a whole in any definite period—as in the case of the pendulum—but in parts, some of these vibrations acting in a different direction so as to confuse others, while some adding their effects to others.

A simple experiment to show the relation of noise and musical notes can be easily made by holding a piece of cardboard against a toothed wheel. Now if the wheel is revolved slowly, but uniformly, a sound will be given out every time a tooth of the wheel passes the edge of the cardboard. At very low speeds, we get sharp clear clicks which are not agreeable to the ear. These sounds can be considered as noises and so long as there are less than about 16 clicks per second, the ear has no difficulty in distinguishing one click from another.

By increasing the speed of the toothed wheel so that more than 16 clicks occur in each second, the noises blend and become a low hum. This is a musical note. If the speed of the wheel is further increased, the musical note gets higher in tone, although not louder. Now if it were possible to increase the speed of the wheel so that the teeth vibrate the cardboard at the rate of 30,000 to 35,000 per second, it would be hard to distinguish whether a musical note was produced or a dull, metallic thud.

The tone of middle C on a piano has a period of about 256 vibrations per second. It is interesting to note that the sound of the cricket is about the upper limit of

audibility. The human voice ranges well within the limits of 65 to 1,044 vibrations per second as subsequently explained. This degree of tone, or number of vibrations per second, is called the pitch and should be distinguished from the volume or loudness as the latter depends upon the amplitude or extent of the vibrations.

A good example of loudness is found in the case of a telephone bell or gong. If it is struck lightly with the end of a pencil, it gives off a sound of a certain loudness which we can just distinguish across the room. Now if the gong is struck harder with the handle of a pocket knife, the edges of the bell will vibrate to a greater amplitude and give off a louder note, although the pitch or rate of vibration per second will remain as before. It is much easier to give a large amplitude of movement to slowly vibrating bodies than to the fast vibrating ones. Thus the lower tones are often heard for greater distances than higher tones.

There is another property to a musical note, or articulate speech, which enables us to distinguish between different kinds of musical instruments or between the voices of different individuals. This is known as the timbre or quality. This peculiarity of sound is due to the presence of other vibrations than the one which we distinguish as the main vibration.

THE VIBRATIONS OF THE VOCAL CORDS.

This brings us to the consideration of the human voice, which is nothing more than the sound produced by the vibrations of the vocal cords in the throat. Voice is not speech, as the latter is the production of articulate sounds intended to express ideas. Lower animals have voice without speech in the sense that man has these faculties. Then there is speech without voice, as in whispering, and voice without speech, as in singing the scale of musical tones.

Voice is produced when air is driven by the lungs through the tubes leading to the throat so as to strike against the vocal cords. The scheme can be likened to the stretching of two elastic bands of sheet rubber over the end of a wide tube, so that the inside edges of the bands just touch each other. The bands will represent the vocal cords and the tube the windpipe. Now if we attach a pair of good bellows to the lower end of the tube, so as to send a powerful blast of air against the rubber bands from the inside, the pressure will force out the inside edge of the rubber, open the aperture, and allow air to escape. This will cause a fall in the pressure of air and the bands will close together Again the pressure will increase and the edges of the bands be forced out, the action being repeated rapidly so long as the pressure of air is maintained, resulting in a musical tone.

The pitch of this tone would be represented by the number of vibrations per second. It could be varied by increasing or decreasing the tension on the edges of the rubber bands by stretching tighter over the end of the tube or reducing this tension. The intensity or loudness of tone would vary with the amplitude or extent of vibration of the edges of the rubber bands, just the same as in the vocal cords.

The vibrations producing sound vary in different animals according to the structure of the organs and the power the animal has over them. In man the movement of the tongue and lips enables the modifying of the vocal sounds to an almost indefinite extent. Ordinarily speaking, the tones of the voice have nearly all the same pitch and the variety of sounds is due rather to the action of the mouth organs than the definite movements of the vocal cords.

In men the vocal cords become more elongated than in women in the ratio of 3 to 2, giving the male voice a lower pitch which is usually stronger. In advanced life the upper notes of the register are gradually weakened and disappear, owing to the loss of elasticity in the vocal organs.

Historical records show voices as low as 42 vibrations per second and as high as 2,048 per second. This low note is not much above the pitch at which it is possible to perceive musical tones, 32 per second. The highest note which is within the range of the human ear is 73,768 vibrations per second. This is a total of 11 octaves in the musical scale which are within the hearing of a healthy ear.

The quality of the human voice depends on the same principles that govern the timbre or tone quality produced by any musical instrument. The fundamental or musical tones produced by the vocal cords are either strengthened by the resonance of the air passages or mixed by being compounded by a number of partial tones which sometimes strengthen the fundamental or obscure it.

With this brief description of the production of various sounds which must be handled in telephonic transmission, it is well to know how sound is transmitted through space.

We put energy into a body to cause it to vibrate and produce sound. But in order to cause the sensation of hearing, we must have an intervening medium to transmit this energy. All gases, liquids and even solids convey sound in the form of vibrations. Some of these mediums are better transmitters than others, in that they do not absorb as much energy while en route; also some mediums transmit the energy faster than others, as for example most metals transmit faster than the air or any of the gases. Air will transmit sound about 1,100 feet per second at ordinary temperatures, while iron transmits it 17,400 feet in the same time.

Every transmitting medium through which sound travels has a weakening effect upon the sound transmitted. Also a sounding body sends out its vibrations in all directions, the vibrating waves having a tendency to become spherical in shape, so that the sound can be heard in every direction from the point of production.

Having considered the production of sound and articulate speech and the propagation of these vibrations, it is not out of place to know a little about the construction of the ear. The sensitiveness of the ear, as well as its capability of detecting a wide range of sound vibrations, has much to do with the carrying on of a successful telephonic conversation.

HOW THE HUMAN EAR OPERATES.

The two projections on the sides of the head, commonly known as the ears, have but little to do with hearing. In the case of the telephone, this flexible cartilage covered with skin, serves to make a more or less close fit to the telephone receiver cap, so as to concentrate and direct the sound from the receiver diaphragm to the inner or true ear. The latter is embedded in the hardest bones of the body, called the "stony bones," so as to serve as a secure protection for a most complicated and sensitive organ.

The passage from the outside to the inner ear is about one inch long and terminates in a membrane stretched across the end. This membrane is tough and elastic and perfectly responsive to all sounds unless it is penetrated or broken by disease or concussion, caused by loud noises like explosions. When thus impaired, hearing is interfered with or totally destroyed.

Behind this first membrane is a cavity called the

"middle ear" or ear drum, due to its similarity to an ordinary drum. The inside of this drum is filled with air which is maintained at the same pressure as the outside air by a passage connecting with the throat. Thus, if the mouth is opened when loud explosions occur, the pressure will tend to equalize on both sides of the diaphragm or membrane and the tissue be less liable to rupture.

If this passage, from the inner ear to the throat, is closed by catarrh or other similar disorders, the air inside may become absorbed and the pressure of the outside air will force the membane in so as to decrease the hearing or actually cause deafness.

The middle ear or drum is connected to the real organ of hearing, known as the "inner ear," by three small bones popularly designated the hammer, anvil, and stirrup, because of their resemblance to those objects.

The sound waves entering the outer ear cause the membrane to vibrate, which in turn transmits these movements through the three small bones in succession to the nerves in the inner ear, which go to the brain. It is believed by some that these nerves in the inner ear, which number a few thousand, are so constituted that each one will respond to a particular vibration period. Thus if a pure tone is produced, as by a tuning fork of definite pitch, one certain nerve will be caused to vibrate, the sensation of this sound being carried to the brain.

A harmonic chord would cause the several nerves which correspond to the vibration periods of the bodies producing the harmony, to act. A noise might cause all of the nerves to act, resulting in confusion and an unpleasant sensation.

It is estimated that there are from 3,000 to 4,000 of these nerve terminals in the normal ear. The number of these nerves is dependent upon the state of physical health of the person as well as on the age. Thus we can expect that persons having trained and healthy ears will be able to carry on telephonic conversations over longer distances and with greater transmission handicaps, than is possible with the average telephone subscribers. It is this same difference in individuals that brings up the important question: Which is best to accentuate, loudness or clearness, in telephone transmission?

Transmission, to be of value, must convey to the telephone user complete intelligence. Clearness, therefore, is the first consideration. If all telephone conversations could be conducted in sound-proof booths to exclude room noises, then clearness with but little volume would be preferable.

Inasmuch as the best commercial results require that all telephone instruments in an exchange be of uniform design and performance, we must take into account the average requirements of all subscribers and so balance the clearness and loudness that all conditions will be served.

CLEARNESS VERSUS LOUDNESS.

The matter of clearness versus loudness probably will always remain a question for debate. Individually we may not be competent to pass judgment for all of the telephone users in a particular exchange, by our personal test or through conversations, for our range of hearing may be too great, or possibly it may be less than the average. If transmission tests are to be made of real service to the majority of subscribers, then a number of observers must be used and an average taken of the results.

This subject does not contemplate the considering of the distortions and losses in speech due to line and apparatus conditions, but we can lay emphasis upon the necessity for talking directly into the transmitter mouthpiece. If the telephone transmitter is made sufficiently microphonic so as to respond readily to speech when the lips are several inches from the mouthpiece, then this sensitiveness will become a detriment in many telephone locations where room noises are plentiful. The confusion caused by these foreign noises, superimposed on the desirable transmission, will make conversation less intelligible.

TESTING TRANSMISSION.

Simple tests can be made to determine the amount of transmission obtained when the sound is made at different distances from the rim of the transmitter mouthpiece. A device producing a uniform tone within range of average voice frequencies, was placed at different distances from the mouthpiece of a non-microphonic type of a modern transmitter and standard artificial cable adjusted in the circuit so as to represent the loss due to talking with the lips at these distances, zero cable being taken when the sound was produced at the mouthpiece rim. At one-half inch distance there was a loss of transmission equivalent to 3.6 miles of standard artificial cable; at one inch a loss of 11 miles and at one and one-half inches, a loss of 17 miles of cable. Then for this non-microphonic transmitter, fully one-half of the available commercial transmission is lost by having the sound produced one and one-half inches from the mouthpiece. This is taking the limit of commercial transmission at 32 miles of cable.

These same tests, made with a microphonic type of modern transmitter, showed less losses for the same distances, 3½ miles of cable for one-half inch; 5½ miles for one inch and 8 miles for 1½ inches and only 11 miles for two inches.

The actual figures obtained on the foregoing tests will vary with the frequency and volume of the sound, but about the same ratio of results will hold good, so that we are safe to make deductions as follows:

That both the non-microphonic, and the microphonic types of transmitters, require that the lips of the speaker just clear the mouthpiece for maximum transmission.

That the loss in transmission is about twice as much for the non-microphonic transmitter as for the microphonic one, when speaking at a distance of 1½ inches.

That the greater sensitiveness of the microphonic transmitter allows more room noises to be taken up and interfere with the clearness of the transmission.

And finally, that when comparative tests are made with two telephones—one equipped with a non-microphonic transmitter and the other with a microphonic transmitter—it is imperative that the persons doing the talking have the lips exactly the same distance from the mouthpiece for each instrument. A variation of only one-half inch in this distance would mean a loss of 3½ to 7½ miles of standard artificial cable for or against one of the transmitters. When we consider that the difference in the efficiency of two types of modern transmitters seldom amounts to over four miles of standard artificial cable, this error in conducting the test would make the results absolutely worthless.

Every operating company is striving to better the transmission in its particular system by expensive changes in switchboard, line circuits, and substation equipment. In many cases the saving in loss due to such improvements amounts to only a few miles of standard artificial cable. By educating the subscribers to talk with the lips practically against the rim of the transmitter mouthpiece, we can make additional savings, equivalent to several miles of standard artificial cable, and at no cost, outside of that of a campaign of education.

THE TELEPHONE IN THE "MOVIES"

Doc. Crane and Adele Farrington in "The Journal of Lord John"

An Important Incident in "The Supreme Test"

Betty Compson and Eddie Lyons in "The Newlyweds' Mixup"

Louise Lovely in "Bobbie of the Ballet"

The Telephone Is an Important Weapon in "A Fight for Love"

Jack Holt and Ruth Stonehouse in "The Phone Message"

THE telephone is indispensable in the "movies" for the same reason that it is indispensable in modern everyday life. It is not used on the screen as a makeshift only, but it also plays an important role and "adds verisimilitude to bald and unconvincing narratives."

No other stage property equals it in adaptability, for there is nothing so interwoven in the affairs of life,

THE TELEPHONE IN THE "MOVIES"

Herbert Rawlinson in "They Wouldn't Take Him Seriously"

Digby Bell in "Father and the Boys"

Barbara Tennant in "The First Nugget"

Ben Wilson and Dorothy Phillips in "Harmony in a Flat"

Zoe Ray in "Pinkey's Bulls Eye"

Solving the Mystery of "The Haunted Bell"

Peggy Coudray in "Promissory Notes"

Another Scene in "Pinkey's Bulls Eye"

some phase of which every "movie" possessing human interest must portray—or caricature. The naturalness of the scenes shown in the accompanying pictures, for which we are indebted to the Universal Film Company, is convincing. In one way or another, "everybody's doing it," and how the telephone may be used practically can be seen in the "movies."—*Plates by Courtesy of The Telephone Review, New York.*

Telephone Monopoly

BY JAMES G. KELLOGG,

Vice-President Kellogg Switchboard and Supply Company.

In the Chicago *Daily News* of September 26 there appeared an editorial headed "Antitrust Law Folly," the contents of which struck me as indicating a lack of appreciation of the general telephone situation.

In the last paragraph it is said that the antitrust law should be amended so as not to apply to public utilities which are recognized by all authorities as natural monopolies. If you will examine the growth diagram of the associated Bell companies, which appears on the rear cover of their annual report, you will find a startling indictment of a "natural monopoly." The commercial telephone is about 40 years old, and during the first half of this period the "natural monopoly" monopolized the business. At the end of the monopolistic period there were about 350,000 telephones in the United States—less than the Chicago Telephone Company operates today. The rates were so exorbitant that we looked with admiration on our neighbor who could afford to have an instrument installed. This condition was established because the trust, during the life of the Bell patent, was beyond the jurisdiction of the antitrust laws.

About twenty years ago, the Bell patents expired and Independent telephony sprang into being. The country was telephone hungry, and local companies appeared all over the United States. At first the "natural monopoly" tried repressive tactics that make the trust tactics charged against the Standard Oil Company appear amateurish. At the end of about two years there was nothing left for the "natural monopoly" to do but to meet competition by competing. During the latter part of 1898 the Western Electric Company (the manufacturing branch of the American Telephone and Telegraph) was ordered to double its output of instruments. A few months later it again doubled its output. This development was not sought by the trust, but was forced upon it by the communities who could no longer tolerate the arbitrary and unprogressive methods of that organization.

A public service corporation in exchange for its franchise rights assumes certain obligations toward the community in which it furnishes its service. The only means available for forcing the fulfillment of these obligations is fear of competition and control.

If the American Telephone and Telegraph Company fulfilled its own obligations and permitted the Chicago Telephone Company to fulfill its obligations to the public by furnishing toll terminal facilities to Independent telephone companies within the area of Chicago's commercial influence, the Independent companies would not be inclined to push their objections to the proposed Chicago merger, and the attorney-general would not be obliged to see that the sword of competition is kept ready.

Probably very few people in Chicago realize that within the area of Chicago's commercial influence there are over a million subscribers to Independent telephone systems. Under ordinary conditions commerce involves an exchange of commodities so that it is not only these people who need service into Chicago, but we need service to them. The Independent companies furnishing service to these people are well established and many of them furnish service to more subscribers than the Bell organization in their community. These Independent companies appreciate their duty as public service organizations and are fighting for access to Chicago.

When the American Telephone and Telegraph Company is forced either by public opinion or the federal government to accept long distance messages from or for Independent companies, Chicago will be receiving more nearly the proper telephone service to which the city is entitled, and the increased facilities for buying and selling will be worth considerably more than the $500,000 that would be received by allowing the proposed merger. Let the parent Bell company throw open its lines to messages originating in Independent exchanges on the same terms that the associated Bell companies receive and much of the Independent opposition and government suspicion will be mitigated.

During the last few years the government officials have stood aside on account of a certain letter from Mr. Kingsbury of the American Telephone and Telegraph Company to the attorney-general. This letter is known in telephone circles as the "Kingsbury commitment" and purports to be an announcement of the telephone trust's intention to discontinue certain unlawful actions. The United States authorities accepted this letter for its face value, and the result has been that the pernicious activities of the American Telephone and Telegraph have exceeded all limits that they had approached previously. Thus the department of justice is not at the present time inclined to look without suspicion on consolidation projects of an organization which has grossly broken faith with respect to policies definitely outlined by one of its officers.

The telephone situation throughout the entire country is in a state of reconstruction. The pitched battles of the past are no longer the style, but the guerrilla tactics of the American Telephone and Telegraph Company are frequently in evidence. In due time the federal government may have things straightened out, and the American Telephone and Telegraph Company working for the public as a common carrier to the decided advantage of all concerned.

Telegraph and Telephone Service in Morocco

The telegraph system actually in operation in the French Protectorate of Morocco consists of 4,185 miles of wire exclusive of 1,670 miles of military lines. Land lines now interconnect all the ports and the important cities in the interior. Tangier is connected with Rabat by land lines and has also a wireless station. Telephone systems are now in operation in Tangier, and in the following towns of the French Protectorate: Casablanca, Rabat, Kenitra, Fez, Mequinez, and Marrakesh. Tangier, Arcila, and Larache are connected by telephone. Casablanca, Rabat, and Kenitra have also interurban telephone communication and connections are being effected between Casablanca, Rabat, Fez, and Marrakesh.

Galion Central Union Merger

A conference was held recently in Galion, Ohio, between representatives of the Galion Telephone Company and the Central Union Telephone Companies relative to the merger that has been proposed. The utilities committee met with them.

Just what is proposed in the nature of the merger is not known, except that the offer of the local company is to take over the holdings of the Bell people in Galion.

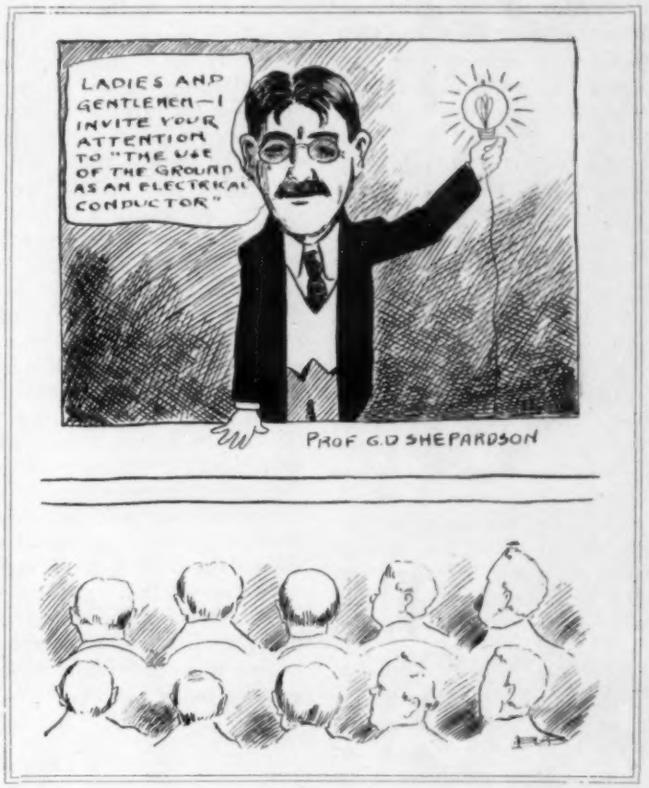
Those representing the companies were Messrs. Mellen, Maltby and Crater of Columbus, for the Central Union, and Messrs. Wolf and Callaghan of Bellevue and Batchelder of Galion for the local company.

The Use of the Ground as a Conductor

Address Delivered Before the Association of Railway Telegraph Superintendents

BY PROF. GEORGE D. SHEPARDSON

THE earth as a conductor, as part of an electric circuit, may be thought of in two ways: As a great reservoir or as a sort of conductor like a great wire. Let us try a water analogy. If we should pour water into the ocean, we should not ordinarily see very much result. If, however, we had a very large stream of water, such as the tides, we would see some effect, the level being changed appreciably. Next, suppose the water to fall not on the ocean, which can move easily and can readily adjust its surface levels, but to fall on the hills or on a pile of sand; then the motion of the water is impeded, and it does not settle to its final level for a considerable time, and a comparatively small amount of water may have widely differing levels. Here are simple analogies to the use of the earth as an electrical conductor. In some cases we may think of electricity going into the earth as into an immense reservoir whose level is not appreciably affected; in some other cases it goes into the earth in such a way that there is considerable resistance; similar to that the water meets when running off from hills and through the ground.



A convention (but unconventional) sketch of Professor Shepardson, who holds the chair of Electrical Engineering in the University of Minnesota.

An example of the electrical use of the earth as a great reservoir or ocean is the lightning arrester. If a charge of lightning strikes any of our circuits, then, if we were fortunate in the selection and maintenance of our protectors and ground connections, the charge will go into the earth as though into a great reservoir, and it may not make any disturbance. If, however, the charge meets opposition while going into the earth, then we have the electrical levels changed, and the current may seek other paths. It is somewhat similar to what we have in our water powers; these utilize the differences in the level of the water which has been deposited on the upper parts of the country; we direct that water through water wheels, so that on its way down toward lower levels it does work for us. In a somewhat similar way, the currents in the earth, whether from lightning or from commercial sources, may get into other circuits and disturb them or might even be utilized.

By a study of the elements which compose the resistance in the earth, we become able to estimate how much a given current will disturb the electrical levels, or how much current will be required to produce a certain amount of disturbance, or how much voltage will be required to send a given current into the earth. With some modification, the ordinary rules for electrical conductors are applicable. We know that the longer a wire is, the greater is its resistance, and that the thicker the wire the less is its resistance. We also know that the resistance of a copper wire is less than that of an iron wire of the same size and length, in other words, that the resistance depends upon a property of the material, which we call its "specific resistance." The electrical resistance in a conductor, no matter what its shape or material, may be expressed in three elements: the length, the area of cross-section, and the specific resistance. (This does not take account of the effect of temperature or of the effects of induction and capacity upon alternating currents.) When it comes to the resistance of an irregular conductor, such as the path of current between a ground connection and the general body of the earth, the application is somewhat complex and involves a more or less tedious and troublesome application of mathematics. I do not care to bore you with a lot of mathematical gymnastics, but will indicate in a general way how the resistance may be estimated.

Suppose we begin with a metal ball buried in some sort of poorly conducting medium, say water or damp earth. By applying the general rule, we can compute the resistance between this ball and an assumed metallic shell surrounding the ball at a short distance away, this resistance being proportional to the specific resistance of the medium and to the distance between the ball and the shell, and being inversely proportional to the area of the intervening medium; the latter may be considered as the average section of the path, or the average between the area of the outer surface of the ball and that of the inner surface of the surrounding shell, provided that the distance between ball and shell is small, so that the two areas are nearly equal. Similarly, we might compute the resistance between the first shell and a similar shell a short distance further out. Continuing this process step by step, we could take the sum of the various steps, and thus we

could calculate the resistance between the ball and a shell at any desired distance. Now, suppose we had another ball like the first one, but away off at some distant point; by a similar process, we could calculate the resistance between that ball and a surrounding shell at a distance. Now, theoretically, if the distance between each ball and its surrounding shell should become infinite, each shell would become a flat plane, and the two shells would coincide. If, then, we could get the resistance between each ball and the infinitely distant shell, the sum of these two would be the resistance between the two balls, and the resistance between either ball and the shell would be the resistance between the one ball and the general body of the earth.

All that seems very highly theoretical. Nobody ever saw such a thing, nobody ever did such a thing, and nobody but a theorist would ever think of such a thing. But suppose we make a few trial calculations to test it out. We may determine the specific resistance of water or of some kind of earth, say by measuring the resistance between two metal plates one foot square and one foot apart with the intervening space filled with the earth. We may compute the resistance of such earth between a ball ten inches in diameter and a surrounding shell eleven inches in diameter, twelve inches, thirteen inches, and so forth. We find that after the distance to the shell equals about one hundred times the radius of the ball, the addition of a unit of distance does not add any appreciable resistance because the area has become so large. We may then forget about the infinite distance implied in the theoretical equation, because practically all of the total resistance between the central ball and the infinite shell comes within the first one hundred diameters.

We may next take another step from the purely theoretical case toward actual conditions, by abandoning the assumption of a ball or sphere as the earthing terminal or electrode. We may take the ball and flatten it out into a plate or draw it out into a long strap or wire. Since the fundamental theory shows that the resistance per unit distance from the terminal decreases more rapidly when the radius of curvature is small, then if we can make our ground plates to have everywhere a sharp radius of curvature, we shall find that the total resistance from that plate to the ground has become quite small. The practical conclusion is this: If our ground plate is to have say six square feet of surface, it will give us very much lower resistance to the ground if we spread it out as a long wire, than it would if we use it as a square or round plate.

We might think of this from a little different point of view. Suppose we take a flat surface and think of the current as radiating in all directions. The current which leaves the edges diverges rapidly, and the result is that when we get a foot away from the sharp edge, the current which left the sharp edges has spread out over quite a large area. On the other hand, the current which leaves the flat surface keeps on going out in nearly parallel lines for quite a distance; the result is that when we get say a foot away, the current which left a square inch of flat surface is still going through a path of a square inch cross-section. The result is, therefore, that the effective area of the conductor does not increase very fast as the current gets away from the flat surface, but it does increase very rapidly as the current leaves a sharp edge. That is the reason why we should make our ground connections by burying a rod or a long straight wire rather than by burying a thick plate. Of course that may be carried to an extreme. We must consider durability and cost of burial, and also the resistance within the ground terminal itself. Therefore we compromise.

Now let us consider another point. The specific conductivity, or its reciprocal, the specific resistance, of the earth is important. The resistance of dry earth is high, that of damp earth is comparatively low. We obtain low specific resistance by placing our earth terminals in permanently damp earth, as by digging deep. We may help some by keeping the ground moist, as by retaining water in some way. One has proposed forming the ground plates into cups to hold the water after a rain, a rather temporary expedient, for the ground near the plate should be permanently damp. A more promising plan, where naturally permanent dampness is difficult to reach, is to put into the earth some substance which will hold moisture by special attraction. An old method was to bury the plate in charcoal or coke, materials which have strong affinity for moisture. A later method is to bury the ground plate or terminal with salt or chloride of lime. The main thing is to keep down the specific resistance of the earth close to the ground plate.

In the actual measurement of the resistance to earth, inaccurate results are sometimes obtained because of failure to appreciate that the terminals should be a considerable distance apart. The method used by the Bell telephone companies is quite satisfactory. They use a Wheatstone bridge, with alternating current obtained from a buzzer circuit, and with telephone receiver instead of galvanometer, and measure the resistance between each two of three ground rods; from the three measurements, the resistance of each separate ground may be computed. It is necessary to keep the ground rods or plates a considerable distance apart, in order to avoid getting false results.

Trouble Shooting

By W. T. Satterwhite

Trouble shooting requires head work and politeness as well as marksmanship.

The trouble-shooter, as most people call them, may be an expert in his line; he may be able to find the cause of trouble instantly and repair it with speed and skill, and still he may fail utterly in his mission, which is to leave the subscriber a friend of the company. If he is cross, sarcastic, hurried and abrupt, if he is careless of his feet or strews his repair kit about the room, or argues with the subscriber, he will cause more trouble than was there in the first place.

When the trouble-shooter goes to a subscriber's house to fix a telephone he represents the company. What he does there will be either charged to the company or credited to the company. His manner, his words, his use or lack of tact, are all as important as his ability to fix the trouble. He can be too polite and too loquacious, as well as too grouchy.

I think it a good idea for the trouble-man to occasionally ask a subscriber whom he meets on the street if his telephone is satisfactory, or if he is having any trouble with his service.

It shows the subscriber that the company's men take an interest in their service beyond the flat demands of the subscriber. If the troubleman will consider these things it's a good three to one bet that he will climb to a higher position. He is bound to rise, because the company needs employes who use their heads more than their hands and feet.—*Southern Telephone News.*

Long Distance Telephony

Written for the Special "Two Thousandth" Number of the Electrician

BY B. S. COHEN

THE history of long-distance telephony has been a record of comparatively gradual and uniform progress unmarked by any revolutionary strides until within the last few years.

Improvements in the propagation of telephone speech broadly resolve themselves into two main groups: Firstly, the development of the sending and receiving apparatus; and, secondly, the development of the propagating medium, *i. e.*, the line plant.

Notably progressive steps in the early days in the first group were the introduction of the induction coil, enabling the telephonic voltages to be stepped up and the percentage resistance variation of the transmitter circuit to be greatly increased. The introduction of the granular transmitter and the use of double-pole permanent magnet receivers can also be included as notable steps.

As regards early progress in the line plant, prominent land marks were: the introduction of copper and bronze wires in place of iron, the replacement of the single wire or earth circuit by the metallic circuit and the inductive balancing of lines by means of rotation and transposition, thus minimizing the effects of electrostatic, electromagnetic and leakage disturbance.

For many years after the introduction of these fundamental improvements the development in long-distance telephony was extremely gradual. Telephone development generally was chiefly concentrated on the pressing problems of providing local telephonic communication to the increasing number of subscribers; and the large towns and their suburbs were gradually provided with telephonic communication and formed more or less isolated nuclei only interconnected by long-distance lines to a limited extent, and the maximum commercial limit was reached at a comparatively short distance.

The increase in the use of the local telephone, so far from assisting in the progress of long-distance telephony, at first actually tended to retard it technically, although providing sound financial reasons for the construction of intercommunicating lines between the large cities. The replacement of open wires on the introduction of telephone cables overhead and underground firstly for junction lines, and then also for subscribers' lines, although greatly improving the reliability of the local service, resulted in increased difficulty in long-distance transmission owing to the lower speaking efficiency. Traffic improvement also, designed to increase the speed and reliability of connection was too often obtained by the use of more complex signaling circuits introducing unconsidered transmission losses. Finally, the development in electric tramways, railways and power schemes, introduced further problems with regard to the more efficient protection from inductive and leakage disturbance.

During this transmission period the inventor in the domain of long-distance telephony appears to a very great extent to have concentrated on improvements in the transmitting and receiving apparatus. A notable exception was the introduction of dry core paper cable which at once reduced the capacity to about half and thus increased the talking efficiency about four times. Even so, the cable line still gave a much lower transmission efficiency than the open wire because of its capacity.

Early Limits of Long-distance Telephony.—It will be of interest to consider the limits of long-distance telephony before the developments of the last few years.

The high-water mark in long-distance line construction was reached on the introduction of 800-lb. copper aerial lines carefully insulated, rotated and regulated, to reduce leakage and inductive losses and disturbances to a minimum. A length of 45 miles of 800-lb. line is approximately equal in transmission efficiency to 1 mile of standard cable, and working on the assumption that the efficiency of a long-distance line cannot safely be reduced beyond that given by 20 miles of standard cable, having regard to other losses in the apparatus, and subscribers' and junction lines, etc., this gives a maximum radius of 700 miles. The cost of such construction is extremely high, amounting to about $425 per circuit-mile with copper at $480 the ton, or a total for the limiting value of $380,000.

It must also be noted that the assumption is made that there are no intermediate or terminal lengths of cable which, however, become necessary when leading the line into its terminating cities.

Modern Progress.—The era of scientific long-distance telephony may be said to date from 1887, when Oliver Heaviside published his classical paper on "Electromagnetic Induction and its Propagation." This paper was the first that clearly indicated the possibility of annulling the effects of distributed capacity. The late Prof. S. P. Thompson appears to have been the first to suggest a practical application for annulling capacity effects, and in a British patent dated 1891 he described methods involving the use of distributed leakance or, alternatively, bridged self or mutual inductance. Prof. Thompson's methods have never been practically worked out and applied, and in the light of present-day knowledge it can be demonstrated that the leagage method would only diminish the distortion of the telephonic waves at the expense of considerable reduction in the amplitude.

Telephone Line Loading.—In 1899 the theory and practice of inserting inductance coils in series in telephone lines to annul the capacity effects and thus reduce the attenuation was described by Prof. M. I. Pupin, and in the next few years this fundamental departure was rendered commercially applicable by Prof. Pupin himself and the engineering staffs of the American Telephone & Telegraph Company and the allied Western Electric Company. In this connection it may be of interest to mention that the question of inserting series and bridged inductances in telephone lines was considered, and inductance coils constructed and experimented with at an early date by the British Post Office.

The telephone line inductance coil, technically known as the loading coil, became, however, a practical proposition on the introduction of the modern form with an iron core. The modern loading coil of the highest quality with a very finely divided iron core has a ratio of R/L, or effective resistance to inductance at telephonic frequencies, of 25. It will be of interest to compare this figure with the ratio of about 4,000 for an ordinary solid core

electromagnet coil as used for telephonic relays, etc. The introduction of the loading coil had an immediate effect on long-distance telephony, not only enabling open wire lies to be considerably extended, but permitting of the use of long-distance cable lines of not excessive conductor gauge.

Table I gives limiting lengths of 300-lb. open wire conductors, loaded and unloaded, on the assumption that the equated length should not exceed 20 miles of standard cable.

TABLE I.—LIMITING LENGTH OF 300 LB. OPEN WIRE LINE LOADED AND UNLOADED.

Inductance added henries per mile.	Effective leakance per mile in micromhos.	Limiting length in miles.
Unloaded	2.5	340
Unloaded	1.0	372
Unloaded	0.0	392
0.037	2.5	492
0.037	1.0	734
0.037	0.0	1,060
0.017	2.5	492
0.017	1.0	642
0.017	0.0	784

The detrimental effect of leakance on loaded lines will be noted from these figures.

The 300-lb. open wire line, loaded to give an improvement factor of 2.7 with infinite insulation has the factor reduced to 0 when the effective insulation falls to 187,000 ohms per mile. It will also be noted that with a leakance of 2.5 micromhos there is no advantage in heavy loading. The problem of leakance with open wire lines is probably more acute in the United Kingdom than in any other country which has progressed to the point of having extensive long-distance telephone lines, but even here the experimental loading of a 300-lb. open wire conductor may be considered a commercial success. A maximum leakance value of 2 micromhos per mile can be assumed for very wet wintry weather.

Table II of notable foreign loaded open wire lines is not as complete as it might be owing to the unfortunate difficulty in obtaining definite figures for the leakance, which can only be inferred by calculation back from the given attenuation constants.

TABLE II.—FOREIGN LOADED OPEN WIRE LINES.

Line.	Length in mi.	Electrical constants per mile. Resist. ohms.	Induct. henries.	Capacity mfds.	Attenuation.	Eq'ated length in miles of standard cable
New York to San Francisco—						
435 lb. copper	3,400	4.95	0.0365	0.0091	0.0013	41
Berlin to Rome—						
500 lb. bronze	1,300	4.6	0.0354	0.009	0.00177	21

The attenuation constant of 0.0013 for the transcontinental American lines indicates a very high insulation resistance and illustrates the great climatic difference between the United States and Europe. The inferred insulation for the Berlin-Rome line as deduced from the attenuation constant is considerably lower. It should be noted that in both cases the lines are duplexed and the phantom, as will be mentioned further on, loaded. The loaded phantom would be higher in efficiency than the loaded side circuit. In addition the New York-San Francisco line has telephonic speech relays inserted, which will considerably reduce the equated length. The rate for a 3-minute conversation is $20.70, but it must be remembered that plant valuing $2,000,000 is involved.

Loaded Cable Lines.—The advantage of long distance underground cable lines from the point of view of freedom from disturbance, both electrical and storm produced, are obvious, and have been well exemplified recently in England by the havoc wrought during the great storm in the early part of this year when the underground main lines between London, Birmingham, Liverpool, etc., may be said to have prevented the almost entire temporary dislocation of long-distance telephonic communication in this country.

It is not loading alone that has rendered the long-distance underground telephone lines a paying proposition, but the additional possibilities of duplexing.

The superimposing of a third circuit on two existing circuits and the loading of both the existing and the superimposed circuits, or, as they are technically termed, the physical or side circuits and the phantom circuit, is a development of the utmost importance.

This application has been rendered practicable by the use of multiple twin cable in which the twisted pairs of conductors are themselves rotated with respect to each other. This in itself is insufficient to prevent overhearing, and requires to be supplemented by the accurate inductive balancing of cable pairs. This balancing has been highly developed in this country. The method adopted is to measure accurately the wire to wire and wire to earth capacities of all the conductors in each short section of cable as laid and to so join up the sections as to give a capacity balance accurate within a few micro-microfarads.

Table III gives particulars of some important long-distance loaded cable lines.

Terminal Reflection and Transition Losses.—The high characteristic impedance of loaded lines has brought into prominence the reflection losses caused by the jump from the propagating medium to the terminal instrument, or *vice versa,* and by the transition from a line of one characteristic impedance to a type with a much higher or lower value.

These effects are readily calculable, and tapering methods which minimize the abruptness of the change can be utilized to minimize or even totally annul these losses. These methods need not be entered into here.

Telephonic Speech Relays.—A further development of considerable importance is the production of a practicable telephonic speech relay. From the earliest days of telephony inventors have been attempting to produce apparatus capable of efficiently relaying telephonic speech waves, and until quite recently the great majority of these attempts have been mechanical contrivances coupling some form of receiver and transmitter. The electromechanical type of speech relay has, however, now found a serious rival in the gas discharge relay, of which a number of designs are available and which is capable of giving considerable improvements when used on long lines.

TABLE III.—PARTICULARS OF LONG DISTANCE LOADED CABLE LINES.

Line.	Length in miles.	Conductor weight, lb. per mile	Resist. ohms.	Electrical constants. Induct. henries.	Capacity mfds.	Attenuation.	Approx. equated length in miles of standard cable
Boston to Washington	475.0	175	17.0	0.15	0.07	.....	32
do phantom circuit	475.0	350	10.5	0.1	0.1	.....	26
London-Liverpool	200.5	100	18.38	0.053	0.0568	0.0107	22
do	200.5	150	13.13	0.054	0.0697	0.0088	16.5
do	200.5	200	9.62	0.054	0.0655	0.0066	12.9
do	200.5	300	6.55	0.055	0.0568	0.0041	9.1
do phantom on 150 lb.	200.5	300	6.56	0.035	0.1057	0.0075	14.2

Submarine Cable Telephony.—Submarine cable introduces a difficult problem in long-distance telephony. The objection to using dry core paper dielectric appears almost insuperable, and the addition of loading coils becomes a more difficult problem than in the case of underground cables. Coil-loaded cables have, however, been

successfully laid by the British, French and Belgian administrations, and are now in satisfactory operation.

An important step in advance is the use of a special G. P. dielectric which gives a ratio of leakance/capacity or G/C of the order of 12. The ratio G/C is an important factor in transmission efficiency, and the value of this ratio for the old form of G. P. dielectric is of the order of 120. This value applies to the first Anglo-French loaded cable laid in 1910.

Loading coils inserted under the cable sheathing have been adopted, and full particulars of such cables as the Anglo-French, Anglo-Belgian, etc., have been published.

Continuous Loading.—The advantages of continuous loading, which has been advocated in some quarters as a general substitute for coil loading, appear more marked when applied to submarine cables, and a number of continuously loaded submarine cables are in operation, notably a Franco-British. By continuous loading is understood the application of inductance continuously to the conductors by means of a wrapping of iron wire or tape.

TABLE IV.—GIVING SOME DATA OF LOADED SUBMARINE CABLE.

Cable.	Length nauts.	Conductor weight in lbs. per naut.	Resist. in ohms.	Electrical constants per naut at 800 ∽ Induct. in henries.	Capacity mfds.	Ratio G/C	Attenuation.	Equated Length in M.S.C.
Anglo-French (1910)	21	160	20.9	0.102	0.138	120	0.017	4.16
Anglo-Belgian (1911)	48	160	25.7	0.1	0.162	12	0.018	8.5
do phantom	48	320	11.7	0.05	0.314	12	0.0173	8.5
Franco-British (1912) continuously loaded	21	300	8.54	0.0135	0.176	109	0.0185	3.75*
Anglo-Irish (1913)	64	160	21.0	0.1	0.166	15	0.015	9

*The constants of the Franco-British continuously loaded cable have been measured at 1,000 ∽.

The main disadvantages not common to the coil loading system are the comparatively low inductance which has been attained, the additional capacity caused by the iron wrapping and the increase in bulk and cost. The main advantages are the absence of loading coils at intervals and the slight reflection caused by these coils. The loading coil has also to be carefully guarded against excess currents which might introduce a reduction in efficiency by magnetization.

In connection with this table it may be explained that the Anglo-French 1910 cable is not phantomed, but that in the case of the Anglo-Belgian and Anglo-Irish cable, the conductors are phantomed and the phantom circuit loaded. This results in the increase in effective resistance per naut due to the introduction of the phantom loading coil despite the fact that owing to progressive improvements in R/L loading coil ratios the effective resistances of the Anglo-Belgian and the Anglo-Irish show a progressive decrease over the unloaded conductor value. The greater efficiency of the Anglo-Irish cable over the Anglo-Belgian will be observed to be entirely due to lower effective resistance per naut.

Wireless Telephony.—Wireless telephony seems destined to play an important role in what may be called ultra long-distance telephony, and the fine inter-continental achievements in this direction by the American Telephone and Telegraph Company are still quite recent.

No technical details of the system adopted in the recent transatlantic telephone experiments are yet available for publication. Prior to this achievement successful experiments had been carried out by Italian, French, American and English investigators, and results up to 600 miles distance had been successfully obtained. In this connection the results obtained by Prof. Vanni between Rome and Tripoli (1,000 km.) may be mentioned.

The principle generally adopted is to superimpose telephonic waves produced by telephone transmitters on continuous oscillations produced by a high-frequency alternator or other source. These oscillations pass from the receiving antenna through a detector which may also be a magnifier connected to a telephone receiver. The high-frequency oscillations themselves have no audible effect on the receiver, which, however, responds to the fluctuations superimposed by the transmitter. An important feature is the transmitter. Various forms of transmitter have been used with more or less success, *i. e.*, a jet of liquid, water-cooled forms of carbon transmitter, gas discharge relays, etc., capable of transforming high power current into speech waves.

Conclusion.—The problems involved in long-distance telephony are many and complex, and the theoretical principles first enunciated by Maxwell, Kelvin and Heaviside and since developed by Pupin, G. A. Campbell, Kennelly, Fleming and others, supplemented by the research work carried out by most of the big telegraph and telephone administrations, has resulted in the present advanced position of long-distance telephony, which is favorable to considerable extension of the existing working limits, not only for inter-city but also for international communication when political considerations permit.

The Independent Telephone Industry

In the United States the telephone industry, both Bell and Independent, ranks the fourth industry in the country. There are many hundreds of millions of dollars invested in telephone property throughout the United States. Yet the telephone manufacturing industry represents but a small portion of what it should represent, considering the number of telephones in use, and the number of plants in operation. There are over 15,000 Independent telephone plants in the United States serving and operating more than 6,000,000 telephones. The Bell Telephone Company and allied plants operate nine million telephones, and in fact the telephones of the country go into more homes than practically any other one agency; yet the telephone industry seems to be small. The manufacturing end of the telephone business is only a small portion of what it should be. At the present time we should have twice as many Independent telephone manufacturing plants in operation. In the South, consisting of eleven states, there is not a single telephone manufacturing plant. This is not as it should be. An industry as big as the telephone industry could easily support a number of more manufacturing plants. We are inclined to think that there is room for development along this line, more so than in any other business in this country that we know of, and especially right at this time when prosperity is covering the country. Now is the time to develop such institutions.—*Southern States Telephone News.*

A. T. & T. on Philadelphia Exchange

There has been placed on the regular list of the Philadelphia Stock Exchange $683,900 additional American Telephone & Telegraph stock.

Sources of Platinum

Russia had always been the source from which the bulk of the world's supply of platinum has been obtained, states *Engineering* in a recent issue. The main output comes from the Ural Mountains. During 1910, 175,720 ounces of crude platinum was secured, while in 1913 the quantity was 250,000 ounces and during 1914 about 241,200 ounces. The actual output is probably much greater, as a considerable quantity is sold without being officially recorded. The metal is found in placer deposits in several districts, of which the most important are: Tcherdin, Perm, North and South Ekaterinberg, and North and South Verkhotom. The output from these sources has been steadily increasing for a number of years. The richer placer deposits have been derived from the prolonged weathering of a variety of olivine which occurs in the Ural Mountains, in a somewhat narrow zone. They occur also along the mountain slopes in the river beds. The average yield is now under an ounce of platinum per ton of gravel; formerly it was more. The workers have now either to exploit poorer placers, or to develop richer ones in more remote situations which are not only more difficult of access but more troublesome to work. Prospecting has been carried on from time to time, but additional deposits are not readily found. Some of the districts have been worked for nearly eighty years. The Northern Urals have not yet been thoroughly explored, but olivine districts are known to occur there. Dredgers and excavators are now employed for working the deposits.

In Colombia, placer deposits have been extensively worked by the Spaniards since the sixteenth century; they contain both gold and platinum in the proportion of 900 per cent of the former and 10 per cent of the latter. Formerly only the gold was recovered and the platinum thrown away. The districts in which the bulk of the platinum is found are on the Pacific side of the Andes, in the valleys of the rivers Atrato, Aguendo, and San Juan. Both the platinum and the gold found in the placers have been eroded from veins in the rocks of the mountains, high up the water-shed. The output of crude platinum in Colombia is 15,000 ounces in 1913 and 17,500 ounces in 1914.

Placer mines yielding platinum occur in northern California and in southern Oregon; the metal is found there in minute, thin, flaky particles, and is always associated with black sands. It is also obtained from a copper-platinum-palladium ore, the product of a mine in Wyoming, and from a gold-platinum-palladium mine in Nevada. During 1912 the California output amounted to 603 ounces of crude platinum; for 1913 the combined output of California and Oregon was 483 ounces; and during 1914 it reached 570 ounces. Traces of platinum have also been found in British Columbia, a few miles from the village of Tulameen. The platinum is associated with chromite in mines worked for diamonds. It is also reported that platinum deposits of considerable extent have been recently discovered in Spain. They are situated in the Ronda Mountains, about forty miles north of Gibraltar. These mountains are said to have the same geological structure as the Ural Mountains, but the formations of the Ronda section are much greater than the Russian. In the Rhine Provinces of Germany deposits have been discovered which may in the future yield a considerable output. Tasmania and New South Wales in 1914 produced 12,480 ounces. In 1913, 200 ounces of platinum were obtained from Borneo, Sumatra, and elsewhere.

A Submarine Signaling Plant

In discussing the equipment of a modern German submarine the *Electrical News* of Canada has the following to say regarding the one recently captured.

A complete submarine bell signaling plant is installed, with an effective range of 12 miles; fitted with this equipment, the submarine can maintain communication with another submerged boat or similar plant on shore. Transmitting is performed by a large bronze bell placed mouth upwards in the forward superstructure, and supported by a special mechanism so arranged that the bell can be stowed below the plating when not in use, or quickly raised from the inside of the boat, clear of the superstructure, to permit the sound waves to travel out in all directions. The bell tongue is connected to a pneumatic cylinder, the slide valve of which is operated by a Morse key in conjunction with a condenser, the supply current being taken from the distribution box in the officers' quarters. The receiving plant has two special submarine microphones placed port and starboard in the lower forward part of the boat, well below the waterline. On the face of the microphone case is a circular machined grove lined with a thick rubber packing, which forms a perfectly watertight job when pressed on to the hull, through which a small hole is drilled to ensure the diaphragms always making good connection with the seawater. Two telephone receivers mounted on the same instrument box are used to collect the signals in conjunction with a 4-volt primary battery and small-change-over switch to enable either microphone to be placed in circuit. The key, condenser, and telephone receivers are conveniently mounted in the officers' quarters just above the starter for the forward 26-h.p. bilge pump motor, which arrangement allows signals to be transmitted and received very efficiently. Should the vessel accidentally sink in shallow water, the crew inside the submarine can release the safety mechanism known as the telephone buoy, by which the position of the sunken submarine can be located and telephonic communication set up between the boat and surface. The buoy itself consists of a wooden structure covered with 1/16 in. galvanized steel sheeting, and is secured to the superstructure by a screw releasing-mechanism operated by the crew inside the submarine. On top, the buoy has a hinged cover carrying a special watertight flashing lamp; on opening the cover, access is given to a portable microtelephone and push-button. In the boat is a second microtelephone with alarm bell and 4-volt primary battery enclosed in a light steel case, and a Morse key to flash the lamp on the buoy cover. Electrical communication is maintained through a 60-metre long 4-core cab-tire covered cable (two cores for the telephone and two for the lamp), which enters the boat and buoy through bronze stuffing glands or deck tubes. Current for the flashing lamp is taken from the distribution box in the crew space. When not in use, the 4-core cable is coiled up in a special cable locker just aft of the buoy.

Asks Fire Protection in Construction

Adequate protection in the installation of telephone wires and exchanges is sought in Chicago by William G. Keith, commissioner of gas and electricity. In a proposed ordinance Mr. Keith has included numerous changes in the installation for protection against fire.

Eye Strain Among Telephone Operators

Paper Read Before the American Homeopathic Ophthalmological Society

BY DR. LEROY THOMPSON

FOR several years we have been reading about the "safety first" movement, compensation laws and corporation medicine but unfortunately up to within the past four years no great advance has been made in the real work of disease prevention as well as cure in most companies.

The Bell Telephone Company has always shown an interest in the welfare of its employes and long before legislation accomplished anything regarding the rights of the wage earner it made plans and carried them out for the betterment of the health of its working masses.

The Chicago Telephone Company, with whom I have been associated for nine years, typifies the great advance of the whole Bell system, medically as well as in other lines. A comprehensive sick benefit, pension and insurance plan has been organized under the medical supervision of Dr. Alva H. Doty, former health commissioner of the Port of New York. I will not take time to give the details of this organization, except so far as it relates to the subject, but I cannot help remark that nothing but the latest and best in everything has been taken into consideration, gleaned from experience and investigation in Europe and America.

Many of the medical profession are ever ready to criticize a corporation without any definite knowledge to back up their assertions and one of my main reasons for writing on this subject is the appearance from time to time in the public press, and I am sorry to say in medical journals also, articles which do not give the true status of the telephone operator and her health. I will read you one published recently:

There are in the United States about 125,000 telephone girls, whose average term of service is three years or less. The working hours are about eight per day, the average number of calls is about 140 per hour, running, at the peak, to 225 or more. The operator sits facing a switchboard which is covered with numbers, each number having a small signal light that flashes on and off as the call is completed. When the person raises his receiver, a light flashes on the switchboard at central and this light continues to burn until the operator plugs the number and receives the call.

She then plugs the number called for and this light burns until the called person raises his receiver from the hook. When the receivers are finally replaced on the hooks, both lights flash and burn until the operator removes the connecting plugs. To complete one call means four flashes of light. As the average number of calls are 140 per hour, with 225 or more during the rush hours, the operator's eyes are exposed to from 500 to 1,000 flashes of light every hour, resulting in fatigue to the eyes, to say nothing of the mental, physical strain under which the operator constantly works. The Bell system, in 1911, spent $720,953 for rest-rooms and lunch-rooms for the operators, and it has secured sufficient air-space and good illumination, yet, although only young and healthy girls are selected, the average length of service does not exceed three years. The symptoms of eye-strain which the girls develop are headache, dullness, indigestion, exhaustion, nerve strain, insomnia, colds, and so forth. The two or three short years of telephone work possible to the girls, as well as nine-tenths of all their suffering is probably due to the constant near-range eyework, without proper protection for the eyes.

Another article published in the *Good Housekeeping Magazine* is too lengthy to read but makes practically the same assertions.

As oculist and aurist for the Chicago Telephone Company and chief physician for the Employes' Benefit Association, having practically all cases of sickness among the employes come under my observation, I have had an unusual opportunity to investigate occupational disease so far as it relates to telephone employes, with special reference to the eye, and would severely criticise the above article by quoting some statistics.

From April 1 until October 31 of a recent year there were 2 cases of eye trouble, among 2,370 employes (operators and supervisors). Of these 2 cases 1 was due to eye strain and the other to abscess. The maximum time away from work was 10 days, the minimum time was 7 days and the average time was 8½ days.

From November 1 to October 31 of the following year there were 16 cases of eye trouble, among 3,038 employes (operators and supervisors). Of these 16 cases 4 were due to eye strain, 4 to conjunctivitis, 1 to keratitis, 2 to ulcer of cornea, 1 to infection of the lid, 1 to opacity of cornea, 2 to astigmatism, and 1 to congestion of eyes. The maximum time away from work was 63 days, the minimum time was 5 days and the average time was 10 days.

From November 1 to October 31 of the following year there were 12 cases of eye trouble among 3,391 employes (operators and supervisors). Of these 12 cases 6 were due to eye strain, 2 to conjunctivitis, 1 to iritis, 1 to congestion of eyes, 1 to granulated eyelids, 1 to chalazion. The maximum time away from work was 43 days, the minimum time was 6 days and the average time was 6 days.

From November 1 to October 31 the following year there were 18 cases of eye trouble among 3,895 employes (operators and supervisors). Of these 18 cases 7 were due to eye strain, 2 to conjunctivitis, 1 to infection of the lid, 1 to chalazion, 1 to pink eyes, 2 to inflammation, 1 to corneal erosion and 1 to stye. The maximum time away from work was 49 days, the minimum time was 10 days and the average time 8 days.

From November 1 to October 31 the following year there were 38 cases of eye trouble among 3,073 employes (operators and supervisors). Of these 38 cases 9 were due to eye strain, 1 to abscess, 5 to conjunctivitis, 2 to iritis, 2 to keratitis, 2 to ulcer, 11 to infection of the lid, 1 to opacity of cornea, 1 to ryalitis, 2 to aralazion, 2 to inflammation, 1 to stye and 1 to optic neuritis. The maximum time away from work was 136 days, the minimum time was 11 days and the average time 17 days.

From November 1 to February 1 the following year there were 4 cases due to eye trouble among 2,789 employes (operators and supervisors). Of these 4 cases 1 was due to eye strain, 1 to abscess and 2 to conjunctivitis. The maximum time away from work was 21 days and the minimum time 11 days, the average time 12 days.

To sum it up we only had 90 cases of eye trouble in four years and ten months. Does this look as though telephone operating was injurious to the eyes?

Before a girl is taken into the employ of the telephone company she is given a physical examination and her eyes are examined as far as practical vision is

concerned, viz: the test requires that she read letters with each eye separately equal to J. 5, at arm's length. Any defects of speech are noticed and the hearing tested, anyone being below normal being rejected. Glasses do not exclude if vision is J. 5, with them on.

Of course this keeps out many who would otherwise succumb to eye trouble of one kind or another, but it is impossible to eliminate everyone who suffers only a slight abnormality or latent ametropia.

I think the efficiency of such an examination is aptly illustrated by what I saw on a visit to an exchange the other day: One group of 27 girls, all active, healthy looking specimens of young womanhood, and not one wearing glasses; another group of 18 and only 3 wearing glasses.

Go into any large office and look over the clerical force and as you all know the percentage of these who are forced to seek the assistance of glasses will be high.

In a special study made recently from 3 of our largest exchanges, employing 707 girls, only 71 were found to be in a physical condition which necessitated a complete physical examination, and of the 71 there were only 2 taken off duty as being too ill to work.

Dr. John McClellan, traffic department special physician, found the following conditions present in the 71 cases: General health, 20. Hygienic advice needed. Chalazion, 1. Incipient Graves disease, 1. Simple goitre, 7. Possible Graves disease, 1. Organic lesion, 1. Nervousness, 2. Acne, 3. Arterial sclerosis, 1. Hysteria, 1. Anemia, 9. Hernia, 1. Possible tuberculosis, 22. Throat, 1. Definitely tuberculosis out of the 22 suspects, 5.

The telephone operator sits facing the switchboard with her face approximately 16 inches away, measurement taken at the level of the eye. The maximum distance at which she uses her eye when reaching to complete a call or pick it up is 29 inches. When answering a call or completing a connection an experienced operator does not have to concentrate on every number but knows intuitively where the particular numbers are to be found.

Compare the work done by type-setters, book-keepers, stenographers and draftsmen and you can readily see that a telephone operator has as much relaxation and sometimes more than any of the others who continuously apply themselves to their given occupation, which is all practically at the same distance from the eye.

The signal lamps, the strongest of which is less than one candle power, has a protecting cover, or opal, as it is called, made of glass which is semi-transparent, measuring nine millimeters across at the greatest diameter and six millimeters thick, being made in three colors, white, red and green. These opals amply protect the eye from ultra-violet, chemical or dazzling rays.

The average time any of these lamps are lighted is three and one-fifth seconds and it is not necessary that the operator look intently even that long at any one light. The arrangement of numbers, in groups of five with plain lettering and individual marks, makes the finding of the numbers by the operator almost intuitive after she has worked for a few days. In other words, she does not have to look intently to read every number before a connection is completed. The illumination of her work is as nearly perfect as engineering and science can make it, careful provision being made to protect the eyes from any direct rays and yet afford ample light to see the numbers. Every operator has a relief of fifteen minutes for complete relaxation every two hours, and one-half to an hour for her lunch, which is provided in the exchange.

Dr. George M. Gould, the author of "Eye-Strain and Occupational Disease," says in part:

The intolerable fact that stares at one from every page of the United States report concerning telephone operators, is that not the slightest hint is given that the girls and nine-tenths of all their awful suffering and wrecking is largely due to constant near-range eye work without scientific spectacles. No blame attached to the companies. The fault is the great indifference to, or ignorance of the nature and consequence of eye strain.

In reading the United States Government report I cannot find where any original scientific research work has been done but practically all their preposterous conclusions are based on the Canadian Parliamentary report, and more or less ignoring their final conclusions.

The integrity of the doctors who gave their expert opinion is not doubted for one moment but nearly all their conclusions were drawn from observation of a few operators who happened to come to them in their private practice for treatment and whose subjective statements were accepted as facts. What about the thousands who do not have to consult a doctor about their health?

I will quote a few passages from the report:

Reaching upward injuriously affects the nervous system. (Cannot be proven.)

Nervous debility. (Found in all indoor occupations.)

Faces showed indications of weakness on account of strenuous employment. (Would like to show you what a fine looking lot of operators we have in Chicago.)

Eye, ear and throat all strained. (Not proven.)

Nervous Hysteria. (Found in all occupations where girls are employed.)

Constitutional and nervous system all injured. (Not proven.)

Wearing down of the nervous system. Optic and auditory nerves strained. (Not proven.)

Debilitating to the nervous system. (Not more than any other occupation.)

Girls burn up more energy than they produce.

Most exhaustive of all occupations. (Absolutely no.)

Injurious to eyesight. (Note my statistics.)

Produces headaches looking at holes.

Prevents rest.

Cannot sleep when they go home.

Couldn't eat well. (Look at lunch bills expense.)

Reaching is hard and injurious.

Eye trouble, headache and nervous troubles.

Affects the eyes and through the eyes the general system.

The most trying of occupations.

Throat, chest and nervous troubles and headaches.

Nervous prostration and nervous breakdown.

After three years unable to perform the ordinary occupations of womanhood satisfactorily. (If that were true they would not recommend relatives.)

Fainting.

Strain on nervous system through eye and ear.

Nervous exhaustion.

Strain upon the optic nerve and the muscles of the eyes.

Difficulty in fitting the plug in; they seemed to scrutinize it closely.

The nerves governing the estra-ocular muscles which focus the eye upon the object looked at are the nerves where the greatest part of strain comes.

Reaching added to physical fatigue.

When they leave they turn out badly in their domestic relations.

It is this sort of thing that is laying the foundations of the asylum.

Not so much physical as mental and nervous, and exhaustion of nervous energy, a depletion of nervous force.

The reason for such a marked increase in insanity and nervous prostration all over the country.

After five years she would be disqualified to become a wife and mother.

On future generations the effect will be epilepsy and all sorts of nervous diseases.

Dr. Gould says of the above:

"In other words, brave statements of fact and end-results with no recognition of the single cause, ametropia

of eye-strain arising from lack of scientific spectacles."

I cannot but feel that such absurd statements are not worth consideration of any kind but call your attention to the fact that our attendance records show the following: One girl had never been absent for sickness in 8 years. Four in 4 years. Seven in 3 years. 11 in 2 years and four hundred and twenty-five for the past year. This out of a force of over 4,000 girls.

The apparent short length of service of a telephone operator is due to one thing, *marriage,* and they have healthy families as well as happy domestic lives in spite of the statements quoted from our Canadian report and Dr. Gould.

The English Parliamentary Report of the Committee of Medical Officers concerning the conditions of working of telephones does not say that the neurasthenia is caused by the work, but that this, with the anemia and neurotic tendencies, were brought to it by the worker. Errors of refraction, it is stated, became manifest by the nature of the work. The medical officers are advised to exclude candidates showing pronounced signs of nervous stability or anemia, and to insure that candidates suffering from hypermetropia and astigmatism have those defects corrected by proper glasses.

The committee found that 142 out of 248 operators examined had had their health impaired by the nerve and physical strain. On a busy morning there is hysteria, as the girls get worked up, and the words "shivering and panting," "sobbing and crying" are used. "One girl fainted four or five times running."

Another said "Glow lamps are very trying to our eyes." One thinks "sight is affected by the boards being so close." Miss —— was on sick leave for three weeks from neuritis. "Switchboards are so close, great strain to eyes," testifies an operator. "Eczema of arm and abscess of ear." Such are some of the many items noted.

The average annual sick leave absences steadily grow threefold in ten years. In one year the diseases listed in the sick room patients were these in the following order: Faintness, headache, indisposition, bilousness, hysteria, neuralgia, colds, miscellaneous. The disorders most frequently mentioned and most emphasized among the telephonists are nervous affections, digestive disorders, anemia, nervousness, neurasthenia, migraine, headaches, vertigo, palpitation, etc., precisely those found in thousands of patients and for 25 years demonstrated to be due to eye strain.

In Norway the report is that among 390 women there were in one year 11,621 days of sick absence, many because of disease (now recognized as due to eye strain) distributed as follows:

Bronchitis, laryngitis, influenza, etc.	2,482
Neurasthenia, cephalagia, etc.	1,990
Anemia, circulatory and blood trouble	1,705
Gastritis, enteritis, etc.	2,324
Affections of sight	651

According to the English report in Belgium the physical conditions required for admission as telephonist are peculiarly interesting because they indicate some beginning glimmerings of recognition of truths concerning eye strain.

The principal duty of the Belgian examiner seems to be long, exact and useless "verification of the chromatic sense by Prof. Holmgren's method." "Correct chromatic clearness of vision" is the chief requirement and "the test is applied to each eye" and "spectacles may be used in the tests." "A myopia of 6D may at most be allowed" if the visual acuteness is good and hyperopic lenses of any strength are permitted on the same conditions.

The report is a carefully guarded one, by silence or caution refraining, as much as possible, from crediting illness to eye strain, but the drawing truth looks out at one through the lines. Some other callings are certainly as health wrecking as those of the telephonists. It is gratifying to know that a host of nervous and digestive disorders may soon be recognized as originating in eye strain.

The experience of the 19 medical officers agreed in the main with our conclusions. They had no evidence of injury of any of the special senses, they found that errors of refraction became manifest by the nature of the work, but that those errors were easily rectified. No serious or permanent injury from so-called shock had been noticed. Few complaints as to the ear had been made to them. No special observations were offered as to the age of entry. Anemia and neurotic tendencies were emphasized as rendering applications unsuitable for telephone work. Most of them had had cases of neurasthemia but often they found the subject to be of poor stamina to start with and that there were other factors co-operating. A considerable number expressed the opinion that not more than eight hours' duty should be performed in one day, that over-time was most undesirable and that half an hour for dinner was too short a relief.

Out of 248 operators examined 12 made special reference to visual difficulty. On investigation each of these cases was found to have some error of refraction, which was remedied by lenses. A defect of vision which in ordinary life would probably remain latent and cause no ill-effects is likely to become manifest in the performance of telephonic work through the limitation of the range of vision by the proximity of the multiple.

It is advisable to emphasize the point that the work does not affect healthy eyes, but that it may make manifest the existence of errors of refraction. When the medical officers are examining candidates for the service they should give special attention to the possible presence of hypermetropia and astigmatism. Out of 248 operators examined 142 stated that their health had been impaired in some way.

Most of these women and girls would no doubt have found their health affected to some extent by any indoor occupation; but we think the contributory causes which accentuate the nerve and physical strain are as follows: (a) the operator is constantly using three special senses—sight, hearing and speech, (b) there is constant demand on her attention, accuracy is essential and she may have many calls in operation at the same moment, (c) the continual wearing of the head and breast gear, (d) the perpetual jumping up and down and reaching required.

My experience has been one of close association with the operators and supervisors for 9 years and my conclusions are based on that experience and not on a few patients who happened to be telephone operators needing medical assistance. Telephone operators are not subjected to as much eye-strain as the average clerk. Conditions which are apt to be blamed on the occupation have been absolutely proven to clear up after the eye condition was treated and glasses fitted where necessary, the operator continuing at the same occupation under exactly the same working conditions as before.

Was This the First Desk Telephone?

It was an Atlanta man who invented and used what is thought to be the first desk telephone, and the story of how he came to use it is another exemplification of the old proverb, "Necessity is the mother of invention," says Gordon Noel Hurtel in the *Southern Telephone News.*

To Thomas Peters, veteran insurance man belongs the distinction of having first used a desk telephone, and, as he himself says, if he had had the foresight to patent the invention he might today be among the multimillionaires of the country.

Back in the early '80's when Mr. Peters had been called upon to help reorganize the Southeastern Tariff

Association, he became a very busy man, and found it necessary to economize his time as much as possible. In his office in the old Grant building, where is now located the Third National Bank building, he was so exceedingly busy that his telephone calls interfered with his work. Up to that time, 1884, there was not such a thing as a desk telephone anywhere in use in the wide, wide world. Mr. Peters consulted W. T. Gentry, now at the head of the Southern Bell Telephone & Telegraph Company, then the manager of the company's workshops, and he told Mr. Gentry that he must have a telephone on his desk.

Mr. Peters secured an old drop gas light and told Mr. Gentry to insert a telephone wire through the gas tube and connect it with a transmitter to be fastened on the top of the lamp.

"I think it will work," was Mr. Gentry's comment, and he carried out Mr. Peters' suggestion. The result was that Mr. Peters had a desk telephone and believes he was the first man in the world to use such an instrumnt, so far as Mr. Gentry or anyone in this section of the world knew then or now.

When completed, the desk telephone was the figure of a bronze woman, pointing one finger aloft and upon the end of that finger was a small wooden box to which hung the telephone. It was a very unique instrument and would prove today a valuable historical souvenir for the telephone company if it could be found. It may be somewhere in Atlanta, kept as a curiosity by some citizen.

Mr. Peters states that when he moved from his office in the Grant building he left the telephone there and does not know what became of it. He would like himself to get possession of it.

"If I only had had the foresight and judgment," said Mr. Peters recently when talking about his desk telephone, "to patent my invention, I believe I would be a very wealthy man today. Mr. Gentry and I have often talked about the mater and expressed a regret that we did not take out a patent. He says that my invention was like many other devices for which the inventor gets nothing, while they make others rich, because the idea was too far ahead of the times."

It was some four or five years later that Mr. Peters' idea of desk telephones was taken up by the telephone companies of the country. Today they are in use by the millions and have become a necessity in the business world.

Tri-State Clubs 500 Strong in Carnival

That the Tri-State Telephone Company of St. Paul, Minnesota, will have more than 500 persons, representing seven states in which the company operates, in the 1917 Outdoor Sports carnival pageant, was evidenced at a meeting of the newly organized Tri-State Carnival Club at the general offices of the company at Merriam Park. Pledges to participate in the festivities were exhibited from 150 of the Minneapolis employes, from 75 of the Duluth and Superior employes, and from 175 district men and managers in the larger towns of Minnesota, Iowa, North and South Dakota, Nebraska, Wisconsin and Montana.

The order for suits will be placed soon. The selection was a suit of red, white and blue, the company colors, with the company shield on the breast and a dial of black and white on the arm.

Government Ownership Fails to Better Service

A report showing that government ownership of telegraph and telephone lines is not conducive to the betterment of these utilities was presented recently at the meeting of the Farmers' National Congress by Frank G. Odell of Omaha, Neb., who was named chairman of the special committee at the last congress to investigate the subject. While the report did not make any recommendations, it showed clearly that in foreign countries where the government has control of both telephone and telegraph systems, little development is made in the service. The committee studied the proposition from the position of the farmer.

Mr. Odell said more telephones are in use in any one county in Indiana than on all the farms of the United Kingdom of Great Britain, which includes England, Scotland, Wales and Ireland. Only 2,265 farm telephones are in use in the kingdom, according to a report he received from the postal department of England.

The report covers 180 typewritten pages and, when presented, was ordered turned over to the Newland joint commission, which is considering similar subjects. Mr. Odell said:

"The farm telephone is practically unknown in foreign countries where the government owns them. The district of Aisne in France, where there is a population of 518,991, has only 452 farm telephones out of a total of 4,272. In Custer county, Nebraska, an area about the same size as the Aisne district, but with a population of only 25,668, there are 2,527 farm telephones.

"Under government ownership telephone facilities have been largely denied to farmers, because of high rates and burdensome regulations. Even in a country like Germany, where agricultural interests are strong and where agricultural welfare has been promoted by excellent legislation, it has been found impossible, despite a ten-year struggle, to secure telephone rates under government ownership which will not discriminate against the smaller communities.

"Government ownership of the means of telegraphic and telephonic communication originated in militarism. The extension of rural telephone service is greatest in the United States under private ownership—a result due to the initiative of the American farmer, working in cooperation with the telephone companies. Telegraph rates in the United States are relatively lower than in other countries when conditions of service and purchasing power of money are taken into account.

"It is an astounding fact, though one not generally known, that in those countries of Europe in which the telephone service is conducted as a governmental enterprise, there is virtually no rural telephone service. In extending the telephone service, foreign governments have largely ignored the farmer. Consequently government telephone reports as a rule make no mention of rural service, for there is practically none to mention.

"British telephone reports, an exception to this rule, contain brief references to rural telephone service, but the small extent to which the government telephone service in Great Britain has benefited the farmer is indicated in speeches made on the floor of Parliament shortly before the outbreak of the war."

Most men imagine they would like to get rich by business methods; in reality they would rather bowl or play pool.

Wireless Development in Railway Work

Report of Committee No. 9 Association of Railway Telegraph Superintendents[*]

SINCE the invention of wireless telegraphy by Marconi in 1897, continued improvements have taken place until now it is admittedly an efficient means of intelligent transmission, capable not only of being utilized as a supplement to existing means of wire communication, but also to provide reliable communication when all other means are unavailable, due to the prostration of pole lines by storm, or for other reasons.

It was considered a feat when, in 1897, a distance of fourteen miles was covered by Marconi—then experimenting at the Needles station, Alum Bay, Isle of Wight. The American Line S. S. *Philadelphia* was the first vessel equipped, in 1900, and ship to shore communication was then proven to be possible. Thereafter numerous vessels were equipped with wireless apparatus and the accomplishments of wireless in the marine service are so well known to all that more than passing mention need not be made of the matter in this paper.

A new epoch in wireless transmission was marked by the erection of trans-Atlantic stations at Glace Bay, Nova Scotia, and at Clifton, Ireland, which were opened to commercial service in 1907. These stations have been conducting commercial business, in competition with the cables, ever since and at the present time every civilized country is erecting high power stations for international communication.

It was not until November 24, 1913, however, that wireless telegraphy made its introduction into the railroad world and the mind of the railroad telegraph superintendent, for it was on that day the first practical use of wireless was made on trains and between trains and fixed stations, and this practical demonstration, which is now a matter of daily routine, was made on the train and stations of the Delaware, Lackawanna & Western Railroad, equipped with Marconi apparatus.

If there is any doubt in the mind of any one here today that wireless telegraphy is as reliable for the handling of train orders or other commercial railroad work as the ordinary landline Morse telegraphy, that doubt can be promptly dispelled by a trip over the Lackawanna road and an inspection of the radio system now in operation over a distance of 400 miles, with intermediate stations varying from 60 to 200 miles.

The wireless telegraph serves as an auxiliary means of communication, in the event of interruption to wire facilities. There is hardly a railroad in this country which has escaped an entire loss of wire communication on some parts of its line during the past year and during such interruptions almost any amount would be cheerfully expended if some means of communication could be found to ascertain the whereabouts of trains and the conditions existing at points entirely cut off from service.

Early in August of last year wireless telegraphy was the only means of communication with the city of Galveston and other points in Texas during the great tropical storm that swept over the Gulf of Mexico and the southern part of Texas, when communication by wire was impossible. The wireless relieved much anxiety and brought prompt relief. Were it not for the wireless the city would have been cut off from the rest of the world.

The Galveston experience, and the Dayton flood of several years ago where wireless also came to the rescue, suggests that every important city in this country should be equipped with a reliable wireless station, capable of efficient communication when, for one reason or another, the wire facilities are interrupted.

Communication, to a railroad company, is as vital as locomotives and cars. In the east we are visited by sleet storms once or twice a year and sometimes more often. Poles and wires are prostrated; the railroads have difficulty in operating their trains because there is no means of communication available. After each occurrence of this kind we read in the newspapers that some particular railroad intends to spend a million dollars to place its wires underground. The sun shines again, the old service is restored, and the matter is forgotten until the next severe storm comes along. The Pennsylvania Railroad is the only road, thus far, that has placed its wires underground for telegraph and telephone purposes, for a distance of about thirty miles in New Jersey. The cost of placing wires underground is far beyond the resources of most roads and is therefore not likely to become universal. Moreover telegraph engineers do not favor underground construction for many good reasons.

It is therefore evident that reliable and comparatively inexpensive communication is required by railroads and the experience of the past few years has demonstrated beyond a doubt that wireless supplies the need.

Wireless telegraphy is no longer in its experimental state and its cost is by no means prohibitive. Apparatus can be purchased outright by railroad companies and the maintenance and operation thereof is a simple matter. Railroad companies need not go outside of their own organizations to obtain men capable of operating and maintaining the radio equipments; the regular Morse operators can do this work quite satisfactorily. Two stations, fully equipped with wireless apparatus, including towers of sufficient height to work over a distance of 400 miles, cost less than an ordinary locomotive.

Many railway telegraph superintendents, who have been present at association meetings when wireless was discussed, and who have also investigated the question for themselves, have unhesitatingly stated that they are in favor of installing it on their roads but find difficulty in convincing their superiors of the actual need for wireless service; and of course this means that no appropriations are forthcoming for the purchase of the necessary equipment. But when viewed in the light of past history, it is but to be expected that new inventions, especially when intended for auxiliary communication, are slow to impress their importance on the minds of those who do not come in daily contact with the requirements of the service. Nevertheless, the telegraph superintendent, who knows the many troubles which are his during the days when communication is unattainable, should give the matter serious thought and satisfy himself that these troubles can be obviated with the means suggested in this paper. The telegraph superintendent is the first one to be censored when wire communication is interrupted; he cannot borrow communication from his neighbors and if the telegraph and telephone companies have any to furnish, the cost is astounding.

[*]Committee No. 9 consists of L. B. Foley, Chairman, J. F. Caskey, R. H. Corson, W. J. Kelly, and David Sarnoff.

It is not absolutely necessary for each railroad to install towers and wireless equipment along its entire line, especially in territories where one or more roads parallel each other. The different railroads, with terminals in the same city, can erect an efficient station and jointly share the expense of operating it. A few such stations at the more important terminals, operated in this way, would soon convince them of the merits of the system and each railroad could then expand, erecting additional stations along their individual lines, as the service might require.

A good deal of thought has been devoted to this suggestion by the wireless committee, and it was found entirely practicable. Details of the scheme will of course have to be worked out in each case, but the wireless company supplying the apparatus will, in conjunction with the railroads, lay out the best plan of communication. If this proposition is approached from the angle suggested, it will afford the advantages claimed for wireless as an auxiliary and at a very small cost to each road.

Considerable space has been devoted by the newspapers to wireless telephony, and its achievements during the past year justify the belief that wireless telephony will be brought to a state of commercial efficiency before many years have passed, but, the accomplishments of the last year have merely demonstrated the principles and possibilities. At the present moment there is not a wireless telephone on the commercial market capable of giving as satisfactory service as the wireless telegraph.

It must be remembered, too, that if the wireless telephone has any advantages over the wireless telegraph, it will be due to the fact that the telephone can be operated by unskilled persons, whereas the telegraph requires telegraph operators, and until it is perfected to a point where the unskilled person can operate it, it will have no advantages over the telegraph, and up to the present time the wireless telephone has not reached this desired state.

Wireless telephony, when perfected, will be more applicable to moving trains, especially as it will then not be necessary to employ a special man on trains equipped with the wireless system.

Telegraph companies are using shorter poles and a greater number to the mile, guying them in such a manner that they will stay in the ground, but the crossarms and wires do not stay on the poles during some of the storms and even the modern and expensively constructed lines of the telephone companies failed to withstand the storm of March 1, 1914. It is therefore evident that reliable and comparatively inexpensive auxiliary communication in case of emergency is required by railroads and the experience of the past few years has demonstrated beyond a doubt that wireless supplies the need.

Having thus reviewed the subject, it can only be said that preparedness is the slogan of the hour; sleet and wind storms are on the way and we should be prepared to defy the elements and maintain communication at all times.

DISCUSSION

CHAIRMAN E. C. KEENAN: I notice that Mr. Foley did not refer to the achievement in this line by the American Telephone & Telegraph Company for the reason, probably, that Mr. Foley's report was issued so that we could get it about April 20, or at about the time the A. T. & T. Co.'s wonderful wireless was done Your president, therefore, in extending to Dr. Carty, chief engineer of the American Telegraph and Telephone Company, an invitation to attend your meeting, asked him if he would not tell us something about the great achievements in the wireless telephone, in connection with long distance lines, and he has done so in this letter:

"I regret that I shall not be able to attend the meeting of the Association of Railway Telegraph Superintendents in St. Paul. I am glad, however, to respond to your request for a letter regarding the work we have done during the last year in connection with wireless telephony.

"The principal demonstrations of this work are perhaps known to you from the statements made in the press. They are briefly as follows:

"On September 29, 1915, we successfully transmitted speech by wire from the headquarters of the company at 15 Dey Street, New York, to the U. S. Navy radio station at Arlington, Virginia, and thence by wireless telephony across the continent to the radio station at Mare Island Navy Yard, California.

"The next morning we transmitted speech by wireless telephony from Arlington Station to Pearl Harbor in the Hawaiian Islands, where our engineer together with the United States naval officers distinctly heard sentences spoken into the apparatus at Arlington.

"On October 9, still employing our apparatus at the Arlington tower in Virginia, we successfully transmitted speech across the Atlantic Ocean to the Eiffel Tower at Paris, where our engineers in company with French military officers heard the words spoken at Arlington.

"On May 7, in connection with special long distance service which was given as a demonstration for the United States Navy Department, we made arrangements so that the secretary of navy, in his office, carried on a conversation with the Captain of the Battleship *New Hampshire* which was maneuvering some fifty miles away. A telephone connection was also given between the captain and his home in Washington.

"The above demonstrations have shown that there is no limitation to the distances over which wireless telephony is possible. There is no difficulty in handling any required amount of power nor is there any difficulty in obtaining any required sensitiveness at the receiving end. However, the wireless telephone in common with the wireless telegraph still presents a number of problems which have been only partially worked out. I refer particularly to the interference of wireless messages on each other and to the interference from atmospheric disturbances generally known as static, and to the lack of secrecy of wireless messages.

"The telephone company is giving a considerable amount of attention to these problems and we expect that very much will be done in improving wireless in these respects. However, at the present time they form very rigid limitations to the use of wireless. We can say, moreover, that there are inherent reasons why we must expect wireless to always be limited in its application as compared to wire working.

"The spanning of large distances without the use of tangible connection appeals to the imagination and much interest is naturally excited therefore in connection with wireless. Consider it carefully, however, and you will see that wireless transmission is inherently a very imperfect means of conveying intelligence. With it the electrical vibrations conveying the intelligence are thrown out from a tower, either equally in all directions or else with small directional effect, and the minute part which happens to impinge on the receiving apparatus does all the useful work of conveying the intelligence, while the remainder of the energy is spreading out and affecting thousands of other stations and perhaps conveying the intelligence where you wish it not to go or interfering with other transmissions. Considered in contrast to this, wire working has an appealing precision in its operation. The vibrations conveying the intelligence are sent out over the carefully constructed and selected path provided for them. Careful balancing keeps out conflicting disturbances and the message is received only by the places to which the selected path is directed.

"It has been amply demonstrated, therefore, that we must not look to wireless to replace the wire plant, but to extend and supplement it. We feel that the wireless telephone and telegraph has an extremely important field. Due to its inherent limitations, however, it will be very necessary that this field be carefully determined and that wireless communication be limited to it so that improper uses of it shall not interfere with its filling its proper field.

"Considering the use of either the wireless telephone or telegraph for railroad uses, it seems to me that the requirements and conditions of railroad service are not sufficiently different from the requirements and conditions the Telephone Company has to meet in its important toll service to expect that different conclusions in the two cases should be reached regarding the use of wireless. I have no particular suggestions to make now, however, regarding such use. The wireless can, so far as I can see, be considered only as a temporary expedient for railroad use in case of emergency and can in no sense replace a properly protected wire system. As to whether the value

of a wireless installation as an emergency facility justifies at the present time the expense, is a question for the railway officials. Before such a project is carried out, however, it seems to me very desirable that there be a well thought out plan which will insure that the equipment installed will fit in when required with the regular wire facilities and properly supplement them.—J. J. CARTY."

I think we all appreciate the wonderful work and development which Dr. Carty and his corps of engineers have made, and are making, in the telephone field. At our Rochester meeting, we had a pretty good discussion on this subject from Prof. Culver of Beloit. I shall ask the professor to tell us what he has observed of the development during the past year.

PROF. CULVER: Last year we were conducting over the Delaware, Lackawanna & Western Railroad certain experiments, which, not being complete, we didn't care to discuss at that time. Those experiments were subsequently completed. I want publicly to thank Mr. Foley and the officials of the Lackawanna Road for permitting me to carry out certain practical tests over their road. Previous to these tests last summer, about two years ago, through the courtesy of Mr. Patterson of the Milwaukee System, we were permitted to carry out certain preliminary experiments over the cut-off between Janesville and Davis Junction. As the result of this experiment, we carried out certain experiments over the Lackawanna. My problem in that connection was this: I wanted to see if it were possible, in the first place, to do away with the initial expense and cost of maintenance of high towers, and particularly to see if we could not communicate from way stations to a moving train without elevated towers, antenna or aerials, as we ordinarily use the term. The Lackawanna people very courteously gave me every facility and we carried out different experiments between Hoboken and Scranton.

Now, to summarize this, I might give you a very brief account of the crucial experiments which we tried. The station at Hoboken is equipped with standard 5 kw. Marconi set, as also is the Scranton station. I took a small portable receiving set to a little junction point at Danville, which I believe is 35 miles out of Hoboken. With the assistance of a lineman, in 10 or 15 minutes, I was ready for the test. Obviously, we could not erect a high antenna in that length of time. Now, I didn't use any antenna in the ordinary sense of the term. Number 3, the limited, going up, was equipped with their standard 2 kw. Marconi set, with their best operator on board. We picked up the train shortly before it reached Danville. We had arranged to have them continue signals, until they got beyond the water gap, somewhere near Stroudsburg. We could read the train all the time up to the time they stopped sending. Whether we could have read them beyond or not I don't know. I am not sure what the distance was, but I think it was between 50 and 60 miles, between Danville and the Water Gap. I could not say that the signals were not attenuated at the end of the run, but not to any marked extent.

I would say that we did not try to reverse the operation or attempt to reach the train from the way station. However, I did try that on the Milwaukee System and found that it was possible, although we didn't have facilities for covering great distances.

Now, understand, we did that without any spectacular or unusual apparatus, and I am thoroughly convinced from those practical tests, and I think you will agree with me, that when one covers a distance of 50 to 60 miles, you have covered a practical distance. At least, I understand that is about the distance covered by the train sets now in use when elevated wires are utilized at the fixed station. That is, the train will not be over 50 to 100 miles from the station that you are trying to reach. Now, I am convinced that every way station can be put in touch with moving trains, if the train has standard apparatus, and the way station has a simple, portable receiving set, without the use of elevated aerial wires.

I think you will all appreciate, as I know Mr. Foley did, from what he said to me personally, the significance of this accomplishment.

Another word in respect to the necessity or non-necessity of the elevated wires. I think it has been clearly demonstrated that while in certain cases high elevated wires may be useful, in general they are not necessary. Now, I made that statement a year ago, and I am more thoroughly convinced of it than I was then. In some experiments between the Harvard High Tension Laboratory at Cambridge, and Plymouth, Mass., over a distance of 40 miles, a comparison was made of the efficiency of wires placed near the ground for several hundred feet and a large vertical antenna, which had been erected at great expense. We went down to Plymouth, throwing up a couple of wires on a flag pole, and compared the over-all efficiency by measuring the audibility of the signals at Plymouth. The efficiency was only slightly less with this low radiating set than it was with the elevated set. I understand Dr. Carty said in his paper that the directive effect, in general, is not very great, that is, the energy is radiated in all directions. I appreciate what it means to question a statement by an authority such as this gentleman. But I would say that in these tests at Harvard University there was a very marked directive effect. The Navy Department co-operated with me in a series of experiments carried out between Harvard and Newport, and the effect was very directive when using what one might call the "earth" antenna. During these tests I went down myself to Providence to Prof. Watson's laboratory at Brown University. Signals from the "earth" antenna could not be heard at Newport or Providence. Those two stations, Newport and Providence, are nearly at right angles to the direction of the ground wires at Cambridge. Plymouth was *in line* with the general direction of the ground wires, so, I would say, that the effect is very directive, in fact, exceedingly so with the lower antenna.

Now, I want to say just a word in regard to recent development in wireless equipment. There have been some very careful investigations carried out and some rapid strides made. In fact, these investigations have resulted in practically revolutionizing, within three years, the method of transmitting energy by means of electric waves. The old noisy circuit was superseded five years ago by what is known as the quenched system, but that is being rapidly superseded by the arc. For instance, if we take an ordinary direct current arc, a copper-carbon arc preferably, shunted by a simple self-induction and a condenser of suitable capacity, and feed that with 500 volts direct current, there is set up on this side of the circuit (the speaker referred to drawing) an alternating current of frequency determined by the self-induction, and the capacity. Now, that affords an exceedingly simple means of producing electric oscillation necessary to transmit messages and intelligence by wireless means. The over-all efficiency of the arc transmitter is very much greater than that of the older types. The government is going over rapidly to this type of transmission, and the interesting part of that is, that it is exceedingly simple, no transformers, no big condensers, nothing of that kind.

I could not refrain from bringing up here a piece of apparatus to show you how simple the modern equipment is. I set it up in the laboratory some time ago for class demonstration. It is an arc system. Now, there is the arc system. (Indicating.) This is a resistance used to control the direct current which feeds the arc. You see, one does not need a special generator, but may use a standard dynamo giving 500 volts. You may use 200 volts pressure, but 500 is better in most instances. Such an arc usually operates best in an atmosphere free from oxygen, coal gas or hydrogen, being commonly used. This little instrument weighs less than 20 pounds. We tried out some tests between Beloit and Madison with this machine, and I think we used 125 watts, about twice the energy in a 16 candle power lamp. We reached Madison, which is 40 to 50 miles, and my fellow conspirator up there wrote me this: "Your arc was somewhat unsteady, but the signals were loud, so loud that I could draw the apparatus from my ears a distance of four inches and yet hear distinctly." That means, of course, that we could have covered 100 miles with 125 watts of power. For instance, at the present time, the Lackawanna Railroad is using a 5 kw. set to reach Scranton from Hoboken. Of course, they have a lot of interference in New York Harbor. But I simply wanted to show you how simple the modern equipment is and something about its comparatively high efficiency. No transformers, and no great inductances are needed. Now, what does that mean? It means that we have taken a tremendous stride forward in the production and operation of these devices.

Not only has the transmitting end been very much enhanced in simplicity and efficiency, but the receiving end has progressed. In using these arcs, we generate what some of you may know, of course, as continuous waves. These waves are continuous, just like water waves, as far as general form is concerned, and with that sort of electric wave, it is possible to so adjust the receiving apparatus so as to tremendously enhance its sensitiveness in receiving signals. Thus we see that the apparatus of this arc type has not only tremendously increased the transmission efficiency, but it has made it possible to greatly increase the sensitiveness at the receiving end.

That being the case, of course we are all naturally interested, to see how practical this is. In my opinion, arc sets are really just as practical as the other sets, because there is less apparatus to get out of order, fewer working parts, no transformer to break down, and there is practically nothing to it.

I was in the Arlington station a year ago, and the operators were telling me that they were working from Arlington to San

Diego, Cal., with a 10 kw. arc set, so one can see the tremendous advance which has been made.

I would say that we didn't use an arc in the work on the Lackawanna, and some of you might wish to ask just how it was done, but I suppose, in justice to Mr. Foley, telegraph superintendent of that road, who kindly put at my disposal the facilities for trying out these ideas, I should not say how the trick was done. If the plan is worth anything, he should certainly have the first refusal of it.

My feeling is, if any roads are contemplating the proposition of installing some sort of auxiliary wireless service, that it is a wiser plan to engage an electrical engineer who has had radio experience, than it is to go to a wireless company. I have no quarrel with the wireless companies. I am perfectly frank in saying that the wireless companies are limited by what they can sell and use, while as a matter of fact, the art is traveling much faster than the companies are following. Of course, the railroad companies want standard apparatus, but with a good electrical engineer, with radio experience, I am sure that railroad companies can install reliable auxiliary apparatus at comparatively low cost, which will operate, as it has with the Lackawanna, in many emergency cases.

A word as to reliability. We have carried out in the laboratory some experiments which bear upon this point. We have been sending out wireless time signals for a number of years, and this service, I have been told is more reliable, for instance, than the Western Union service. We seldom if ever have our wires down. Storms don't bother us. I think in the five or six years that we have been operating, our aerial system has been down once, and we very quickly put it up.

In its present state of development; the wireless telephone, of course, is not practical, but I think we will rapidly reach a condition where it is. These experiments which have startled the whole world, these telephone talks from Washington to Paris and to Honolulu, were interesting, showing what could be done. Possibly some of you understand the nature of the apparatus which was used in those tests, and know, of course, such apparatus as they used would be prohibitive in every day practical work on account of the cost. I would not depreciate those experiments at all; they were of the utmost value, without doubt.

If you do install wireless auxiliary apparatus, as emergency apparatus, I should earnestly advise putting in the arc system for these reasons: First, it is simple, and second, the cost of the installation is comparatively low, and the cost of maintenance is very small. Furthermore, if you put in the arc system, which uses continuous waves, when the time comes to install the wireless telephone, you can readily transfer from telegraph to the telephone. With very little change, it can be shifted over to the telephone apparatus. In receiving telephone messages by electric waves, the apparatus which receives the message is identical with the apparatus which receives the Morse and Continental code. There is absolutely no change, or I should say, practically no change in the receiving apparatus. Indeed, I originally had a transmitter on this arc set. We took it off because it didn't work very well, but one may change from speech to Morse by switching with a key. I would say, there is no question about Morse work. It is absolutely reliable, except when an electrical storm is actually taking place at the receiving station.

W. J. CAMP: The professor spoke about the direction of the signals in the early part of his speech, and I wanted to ask him if he didn't think the direction was considerably influenced due to the fact of the telegraph and telephone wires paralleling the direction of his talk. I think it would assist appreciably in carrying the signals in that direction.

And also, in the same connection, if there were no telegraph and telephone wires along the railway, in the direction in which he carries on his communications, if your communication would be lower, due to the fact that the presence of these wires amplified the signals?

PROF. CULVER: In studying out the directive effect, either of lower or high aerial wires, our experiments had no connection with the railroad. We found they were very directive. That is more or less well known. I am now getting ready to start another series of experiments to determine which system is the most efficient. I presume, along the railroad system from Scranton to Hoboken, the wire systems do enhance somewhat the over-all efficiency of the device.

A. WRAY: Couldn't you put a telephone transmitter in the circuit?

PROF. CULVER: There are a hundred ways of putting in a telephone transmitter. Of course, the problem with the arc is, that it won't carry power enough. There are certain transmitters made by the Western Electric Company which I think will carry between three and four amperes, and the ordinary transmitter may only carry, as you know, a fraction of an ampere. For large stations, the current running into the earth there is several amperes. For instance, the one at Arlington is continually working on 75 amperes. Of course, that wouldn't be true of a smaller station. With the telephone experiment at Arlington, however, they didn't use the arc. They use an entirely different scheme, which is pretty complicated.

MR. WRAY: Suppose you had an electro magnet in series with a telephone transmitter and battery; the strength of the magnet to be governed by action of the transmitter. The electro magnet to be so placed as to create a blowing effect on the arc. And have the magnet regulated by a transmitter.

PROF. CULVER: The Paulson system uses that, and I think it is a fairly efficient piece of apparatus. With this system a transmitter is placed in series with the field of the generator furnishing current for the arc; the action of the transmitter of course regulates the current flow and arc.

MR. WRAY: Couldn't you handle more power?

PROF. CULVER: Yes, you could use several of these in series. Unquestionably you can use more power when you use a magnetic blow. You can talk farther, if you can get something to amplify the energy. There is no use, however, of putting power in there that you can't handle with the transmitter. I am frank to say that I haven't any great amount of faith in any general form of telephone apparatus but the arc system. It is used, and I think probably will be developed. The thing that one needs for safe transmission by wireless is a high frequency alternator. Of course, there are limitations to an alternator, but what we want is one that will give us from 60 to 80 thousand cycles per second.

THE CHAIRMAN: We all appreciate that the purpose of this committee is to keep in touch with the development and the practicability of the wireless, and it seems to me that it is not going very far into the imagination, when we see the wonderful improvements that are made each year, to find that wireless will be of practical service to the railroads, especially in emergencies. I am sure, if our technical friends will develop, as they have in the last few years, they will find some other way of using it in railroad work.

We have with us Mr. Wilson of the American Telephone & Telegraph Company, who has charge of some wireless development. Perhaps he would like to make some remarks as to the practical use to which we may put the wireless telephone or telegraph as an auxiliary in emergencies, or otherwise.

C. H. WILSON: I don't feel prepared to talk on that subject. I am not a railroad man, but I am deeply interested in the wireless telephone as an adjunct to the telephone system. And we are looking forward to the development of it with intense interest. Our view of the application of the wireless is that it will enable us to reach points which can not be reached by wire.

Now, if it is desired to reach moving trains which cannot be reached by wires, then I think that is an application for the wireless, but that, I think is entirely a matter for railroad men to decide.

Anthracite Telephone Company Sale

Representing a group of Carbondale, Pennsylvania, men, Attorney H. W. Mumford has purchased the plant, equipment and franchise of the Anthracite Telephone Company. The concern furnished telephone service to about 200 subscribers residing in Carbondale, Simpson, Dundaff, Crystal Lake and vicinity. The price was $6,200.

The telephone company has been in the hands of a receiver, M. D. Lathrope, for about two years. The sale was in compliance with an order of court granting the receiver the right to sell. It is understood that the new owners will invest new capital and extend and improve the service.

Municipal Telephones for Lima, O.

Municipal ownership is possible in Lima, O., as the petitions of the socialist party on the municipal ownership of the Lima Telephone and Telegraph Company were approved by the board of elections, which ordered a vote taken on the question. In accordance with the initiative and referendum laws, separate ballots will be prepared and every elector will be given a chance to vote on this question.

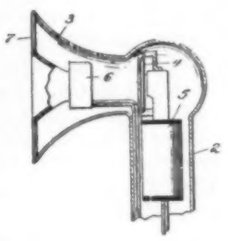
Telephone Patents Issued Recently

A Brief Digest of those Current Specifications Most Interesting to Telephone Men

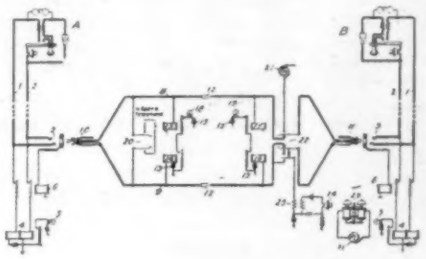
BY DAVID S. HULFISH

NO. 1,195,589. Callsender. Issued to William Kaisling, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. A number setting lever is advanced to the dial number to be called, then the action of the sender advances the dial to the position of the "setting number."

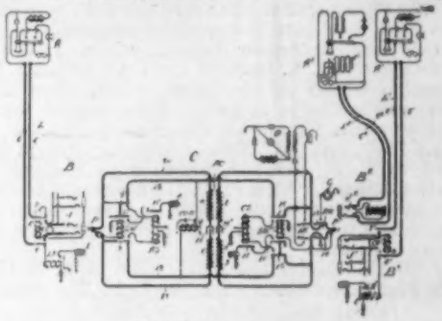
1,195,771. Automatic System. Issued to G. A. Betulander and N. G. Palmgren, assignors to Betulander Automatic Telephone Company, London, England. The system of switching is entirely by relays. A desired group (or directory number) first is indicated by the calling line, and a trunk of that group then picks up the line through an intermediate link circuit.



1,196,562.



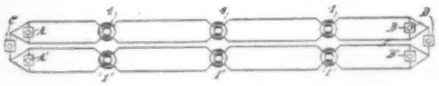
1,196,761.



1,197,163.

1,195,891. Semi-Automatic System. Issued to W. Aitkin and R. Aitkin, London, England. By plugging a manual plug into a numbered jack, an auxiliary device operates an automatic switch to connect the jack to a line of number corresponding to the number of the jack.

1,196,277. Phantom Loading System. Issued to H. B. M. Pleijel and A. H. Olsson, Stockholm, Sweden. Each physical line has loading coils and stray fields are provided for between adjacent coils to produce a loading effect in the phantom.



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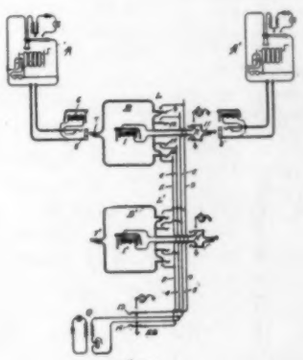
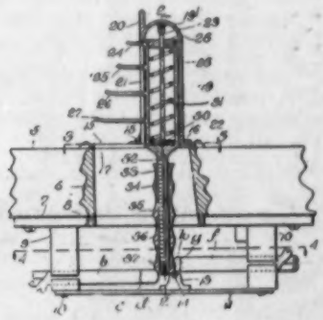


1,196,323.

1,196,340.



1,196,398.

1,196,323. Signal System. Issued to J. S. Allen, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. In the operator's listening circuit is included a common ring-back key and by the operation of the ring-back key the operator may ring the calling line of the cord-pair upon which she is listening.

1,196,340. Hookless Hookswitch. Issued to H. D. Currier, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. The receiver is placed in a clip or slide when not in use and a striker is pushed by the receiver to operate the switch usually operated by the hook lever. Suitable for lightweight receivers.

1,196,398. Combination Key. Issued to Porter O. Robinson, Concord Junction, Mass. The pivoted key lever swings forward to operate the back set of springs as a listening key. To ring, one of the horizontal projections is engaged by the finger of the operator and is pressed down, sliding the corrugated plunger into the front set of springs, giving a code ring corresponding to the number of corrugations, or the depth of the movement, as determined by the fingerpiece selected by the operator.

1,196,482. Automatic Selector Switch. Issued to J. N. Reynolds, assignor to Western Electric Company, Inc., New York, N. Y. A switch having power-driven brushes with double-acting clutch, the brushes being advanced and again restored by reverse action of the magnetic clutch.

1,196,532. Endsignal System for Automatic Exchange. Issued to B. G. Dunham, assignor to Western Electric Company, Inc., New York, N. Y. In connection with a selector and a stepping relay for the selector, a slow relay is combined to act as changeover or endsignal relay and also as release relay.

1,196,562. Combined Transmitter and Receiver. Issued to Herbert E. Lynch, Brooklyn, N. Y. A transmitter and its small funnel are located within the larger funnel of a loud-speaking receiver.

1,196,761. Telephone System. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. While manually ringing upon the called line, a notification tone is given to the called line; in the illustration, a ringer is placed before a transmitter in a local circuit, and the calling party actually hears a bell ring when the called bell rings.

1,196,793. Release Circuit for Automatic Switch. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. A stepping relay and a slow relay are used in combination, the release circuit being controlled at a front contact of the slow relay and a back contact of the stepping relay.

1,196,847. Pay Telephone. Issued to C. J. Erickson, assignor to Automatic Electric Company, Chicago, Ill. (Application filed November 9, 1906.) The patent contains very general claims upon toll devices at the subscriber's telephone for preventing the use of the telephone unless proper coins have been paid into a coin collecting device.

1,196,876. Supervisory System for Automatic Exchanges. Issued to F. Lubberger, assignor to Automatic Electric Company, Chicago, Ill. (Application filed November 30, 1907.) Circuits

from a main exchange to branch exchanges give an alarm at the main office when faults occur at the branch offices.

1,197,048. Automatic System. Issued to W. H. Matthies, assignor to Western Electric Company, Inc., New York, N. Y. The patent contains a broad claim involving the use of two quick-acting relays and one slow-acting relay to control a selector switch for adjustment, changeover and restoration.

1,197,163. Universal Cord Circuit. Issued to R. I. Utter, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. The cord circuit is normally for magneto or local battery lines, but when a common battery line is picked up by a plug a local relay is operated which changes the circuits of the cord pair to give battery current to the common battery line.

1,197,166. Cord Circuit. Issued to C. S. Winston, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. When the answering plug is inserted, the operator's telephone is automatically connected to the cord pair, and when the ringing plug is inserted in the called line jack the operator's telephone is automatically disconnected. The cord pairs are universal for common battery and local battery lines interchangeably.

1,197,185. Automatic Switch System. Issued to E. E. Clement, assignor to J. R. Garfield, trustee, Cleveland, Ohio. A motor is used to adjust an automatic switch, after which action the motor automatically is switched to control another automatic switch upon the action of the next connection.

1,197,989, and 1,197,990. Automatic Switch Release System. Issued to C. S. Winston, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. In a system of release of an automatic switch without the use of a slow-acting relay, the release relay is held by a current in an auxiliary circuit while the switch is being adjusted.

1,198,005. Meter System. Issued to A. E. Case, assignor to Delta Electric Company, Marion, Ind. The meter is at the subscriber's telephone. If the subscriber hangs up the receiver before the operator removes the connecting plug, a call is registered upon the meter; if, however, the operator disconnects the plug before the subscriber hangs up the receiver, the release is effected without registering a call.

1,198,212, 1,198,213, and 1,198,214. Telephone Repeater. Issued to E. Grissinger, assignor to American Telephone & Telegraph Company, New York N. Y. Two magnet poles are opposite each other and an armature is floated between them, the armature carrying one of the electrodes of the resistance button; a circuit for the connection of the device to the line also is shown.

1,198,345. Transmitter. E. Grissinger, assignor to American Telephone & Telegraph Company, New York, N. Y. The moving electrode is caused to vibrate continuously with a natural frequency above the resonating period of the voice waves to be transmitted whereby the resonance effect is ineffective to modify transmission.

1,198,695. Phonograph-Telephone Device. Issued to E. V. M. Brennan, Philadelphia, Penna. A motor-operated device at the telephone connects a phonograph recorder to the telephone when the bell is rung by central, and a timing device cuts off the device after a predetermined period.

Co-operation Between Employer and Emyloye

By Hon. Charles Nagel.

The importance of co-operation has been made doubly manifest in the course of the discussions of preparedness. We are told that there must be a closer relation between the government and commerce and industry. It is also urged upon us that the opportunity for co-operation between individuals and business concerns must be encouraged, if we are to avail of our opportunity to compete successfully abroad.

Perhaps it will not be thought out of place to suggest that there is abundant room for intelligent and patriotic co-operation very much nearer home. It seems clear to me that every community is losing chances by a failure to see clearly that competition alone is not the life of trade, and that mutual support of interests may result in great advantage.

But there is still another phase which impresses me, and which, in many respects, I regard as of first significance. This is the opportunity for co-operation among the several forces engaged in a particular business. I have a professional office. I would not tolerate in my office a man who was not interested in my success. If he rejoiced in the fact that I lost a case I would not blame him, but he would not be regarded as an effective aid in the office force.

This must be true in the same degree of every business concern. I am inclined to believe that as a rule the industries and business establishments of our country command the loyal support of their employes in that sense. In other words, there is manifest a common desire to have the immediate business enterprise of the concern succeed. Let us look at it from another viewpoint. To what extent do the different forces of a business concern agree in judging of legislation and regulating measures which affect a particular business? I not long ago asked a prominent business man whether he believed that he had the interest and sympathy of his employes when it came to consider unfriendly legislation. His answer was in the affirmative. My reply was that I thought he ought to regard himself as fortunate, because I suspected that in a great many business concerns the members of the force were rather inclined to enjoy the discomfort of the proprietors.. When I say this I do not charge bad faith, but I accept that the ordinary conditions prevail; and these are that people do not realize the ultimate consequences of hasty legislation to themselves. I would not favor legislation which gave the proprietor an unfair advantage, but I would advise the employe to appreciate that unfair regulation cannot be imposed upon the proprietor without having the employe ultimately participate in the loss.

The case is not different from that which is presented in much of the so-called anti-trust litigation. We have had most anomalous results. The courts have hesitated to dissolve concerns because they were needed for the protection of the consumer. They have at the same time imposed very substantial fines, because the concerns were not organized in technical compliance with irreconcilable laws. This, at least, has been the situation in quite a considerable number of cases. The business has paid the fines, and the consumers (and I suspect frequently the employes) have enjoyed the process. This illustrates the thoughtlessness with which proceedings of this kind have often been instituted and carried to a conclusion.

I have sometimes asked audiences who in their opinion paid these fines. Of course, the concern itself pays in the first instance; but how does the concern charge it? I should say to the expense account; and I should add that the expense account is ultimately met by an increase in rates to the consumer. It cannot be believed that the business suffers a loss of this kind if it can escape, and it must be assumed that the charges to the consumer will in time be so arranged as to compensate for this loss. In other words, we, the consumers, enjoy the performance, but we do not seem to make it clear to ourselves that we pay the fiddler. If this is true of the consumer, it is equally true of the employe. Rates for goods and rates for wages are all governed or affected by the condition of the business. This business is affected by the regulations that are imposed. If they are unreasonable, an unnecessary cost is incurred, and that cost is ultimately borne by everyone who is concerned, from the proprietor to the employe and the consumer.

A somewhat different question arises where a direct conflict between employer and employe prompts each to take the side which promises immediate advantage. But even in these cases the grounds for decision are apt to be superficial. In truth, the interests are common; the real advantage of one means the true success of the other; and deliberation points the way to a just decision for both.

Public Utility Commission News

Reports Cancerning the Activities of State Regulating Bodies in the Telephone Fiela

California

THE Pacific Telephone and Telegraph Company assumed full charge of the Hughson exchange and lines recently under purchase from F. C. Nickle, by virtue of permission for the change of ownership granted by the State Railroad Commission. John W. Gilkyson, commercial superintendent of the Pacific, has been in Hughson checking up the office preparatory to the change. A new trunk line will be built between Modesto and Hughson, according to a statement issued by Mr. Gilkyson, and the local office will be under the management of the Modesto office. The estimate for this line has already been approved and its construction will be started immediately.

District of Columbia

Major J. L. Schley, formerly executive officer of the public utilities commission of the District of Columbia, having been detailed to the United States Engineer office at New Orleans, Louisiana, the commission has appointed Walter C. Allen, formerly electrical engineer of the District of Columbia, as its executive secretary, and Mr. Allen has assumed the duties of that position.

New Jersey

Seventy per cent of the patrons having by petition to the Public Utility Commission approved of the application of the Hackettstown Telephone and Telegraph Company for permission to increase its rates to those formerly charged by the Delaware and Atlantic Telegraph and Telephone Company, the commission granted the increase.

The Hackettstown company has acquired the property of the Delaware and Atlantic company.

Minnesota

More than 200 subscribers of the Northwestern Telephone Company are affected by an order issued by the railroad and warehouse commission in which the collection of net monthly rental of not less than $1 is required from business men of Austin who have heretofore received free residence telephones when having phones in their places of business. The order took effect October 1.

It is declared in the commission's decision that the practice heretofore of granting this free service to business patrons has been "discriminatory" against the residence patrons paying rentals and against business men not subscribers of the company.

An order was issued in the case some time ago, to be effective September 1, but a stay was granted.

Washington

Because of protests against the $3.50 installation charge and complaints that the mechanism used by the Pacific Telephone and Telegraph Company is obsolete, the state Public Service Commission began an exhaustive examination of the company's plant at Seattle.

In the party were E. F. Blaine, chairman; Commissioner F. R. Spinning, Commissioner A. A. Lewis, James A. Duncan and R. R. Proctor, officials of the Central Labor Council; Fred W. Catlett, president of the Municipal League, and engineers engaged by the Public Service Commission.

The telephone company was represented by F. W. J. Phillips, division commercial superintendent; W. D. Moore, division superintendent of plant; J. H. Corcoran, division superintendent of traffic, and J. P. Dunphy, district superintendent of plant.

An exhaustive examination was made of the company's main plant on Third avenue, which is the largest office in the city. Nearly 6,000 lines enter this building through conduits, and these accommodate 16,477 telephone stations. Although the installation of this plant began in 1909, it was found that it contains every up-to-date device known to telephony.

The members of the commission were shown the intricate system by which a telephone is taken out and a new one installed. It was demonstrated by Division Superintendent Moore that the average cost of installing a new telephone is approximately $8.

"The trouble is caused," he said, "by the fact that the subscriber imagines that screwing a telephone to the wall and wiring the house is all the work that is involved, whereas that is in reality only a minor part. The great bulk of the work is right here."

It was then pointed out to the commission that the company by the installation of an expensive and most intricate system of wiring had absolutely protected the telephone wires against all foreign currents, and that a flash of lightning or a heavily charged light wire coming in contact with a telephone wire would be grounded before it could reach any subscriber who happened to be using the telephone on that particular line.

It was explained that the same protective device is installed in each house where a telephone is used, so that the subscriber is at all times protected against the possibility of severe electric shock.

In this station an incalculable amount of mechanism—millions of small parts of small machines and devices—were shown the commissioners and the various uses to which these are put was demonstrated.

The commissioners talked to the two men in the trouble room whose duty it was to find all breaks or interruptions in the lines and then report them to the other division known as the "hospital."

"Seattle is being constantly built up," explained Moore. "Thousands of carpenters, plasterers and plumbers and other artisans are at work every day, and they destroy many wires and interrupt our service. It is something that we simply cannot avoid. If we used overhead wires the trouble would be much greater."

The commission made a careful inquiry into the conditions under which the telephone girl operators work. Each girl is first put through a course of training in a telephone school before she is allowed to come into contact with the public over the telephone. Fire drill is held once a week, and the 800 operators in the

main office and eighty-five engaged in the toll service can be gotten out of the building in five and a half minutes.

After going through the main office, the commission visited the Elliott station on Fourth avenue, where the school is installed. The system here is about the same as in the main office, that it carries only 8,295 stations. It is constructed as to allow for the estimated growth of the city for the next twenty years.

The party then visited the East station, and shortly before lunch made an examination of the Capitol station, which is the show place of the system. The building is ornately constructed and is surrounded by flowers. Like the others, it is scrupulously clean and sanitary.

Wisconsin

A hearing before the Wisconsin railroad commission was held at Marshfield recently in the city hall to settle a controversy between the stockholders of the North Lincoln Telephone Company and eight farmers within a mile and a half of their line. The North Lincoln Telephone Company is organized for voluntary service only and all subscribers must be stockholders. The trouble arising between the eight prospective subscribers and the stockholders is the fact that the new subscribers desire to secure service on the line without becoming stockholders. This must be the same as that which the stockholders are charged, but the stockholders argue that the new subscribers who would not become stockholders could secure all the benefits of the line without taking upon themselves any expense or responsibility connected with it, other than monthly rental.

The line is not a paying proposition from a business standpoint, and for this reason no other company desires to erect a new line through this territory, even though there would be ten new subscribers who have signified that they would become stockholders besides the eight spoken of before.

The farmers have erected the line for their own use just as any number of farmers might get together and purchase a piece of farm machinery to use between themselves to eliminate greater cost and to secure the service they desire. They are willing to extend a welcome to any of the other farmers who will become subscribers by becoming stockholders and bear as much of the responsibility as themselves, but this is where the trouble hinges.

The commission was represented by R. W. Clark of Madison. A decision will be given later.

Recently the railroad rate commission handed down its decision in the action of J. B. Thompson et al. versus Wittenberg Telephone Company. Early last spring a complaint was filed with the rate commission, signed by twenty-five Wittenberg citizens, wherein it was charged that the business practices of the Wittenberg Telephone Company were inequitable and unfair, the service afforded unsatisfactory and inadequate, and the rates charged unlawful and excessive. Considerable interest was aroused at the time especially during the hearing and taking of testimony by representatives of the commission on the 31st of last May.

At the time it was recognized by all parties to the controversy that it was really a contest between Doctors Pembleton and Thompson, growing out of what Doctor Thompson claimed was the unfair, inequitable and discriminatory manner in which he had been used by the telephone company. The findings of the commission are a vindication of Doctor Thompson's contention, and a rebuke is given to the telephone company. The commission's findings are as follows:

"We find that the practices of the Wittenberg Telephone Company complained of herein are unjustly discriminatory and inconsistent with the duties of a public service company. The specific practices held to be discriminatory are as follows:

"1. Refusal of service on account of an unpaid disputed bill for past services, in the absence of any rule covering the collection of rentals applicable to all subscribers.

"2. Refusal to permit certain individuals to use the telephone system, while permitting any other non-subscriber to do so.

"3. Refusal to permit subscribers or other persons to carry on legitimate telephone conversations with respect to an individual in disfavor with the owner of the telephone system."

Unique Board Is Portable

The telephone exchange which serves Cedar Bluff, Ala., and which is operated by L. W. Witt, is perhaps the only exchange in our territory in which the switchboard is installed in such a manner as to make it portable, says the *Southwestern Telephone News*.

Mr. Witt operates a jewelry store in addition to his telephone property, and his store is attached to his residence, located in the center of the town. He does his own operating at night and during the day desires to have the board located so as to enable him to have close supervision over it. During the day, while he is in the store, the board is located in a room of his residence which connects with the store. The switchboard cable is long enough to admit of the board being moved 20 of 25 feet. A trap door has been made in the ceiling and in the floor of Mr. Witt's bedroom, which is immediately above the room in which the board is located during the day. Attached to the ceiling of the upper room is a pulley. A small windlass is also placed in the upper room. The board is arranged so that a rope may be readily hooked to it without injury to the frame. By these contrivances the board is raised through the trap door at night and lowered during day hours. The cable is fastened securely to the frame of the board in such a way that no loose connections result from moving the board. Rollers are placed on the bottom of the board, which enables Mr. Witt to roll the board to his bed. In this way he answers occasional night calls without getting up.

This unique arrangement has been in use several years and so far the portable features of the switchboard have not been detrimental to the service to any appreciable extent. More than 150 subscribers are served by Mr. Witt's exchange, and this list is growing rapidly.

You don't have to deprive yourself of any pleasures to build up a bank account, because at any time you can change your mind and spend the money.

Don't judge a man's salary by the cigar he smokes.

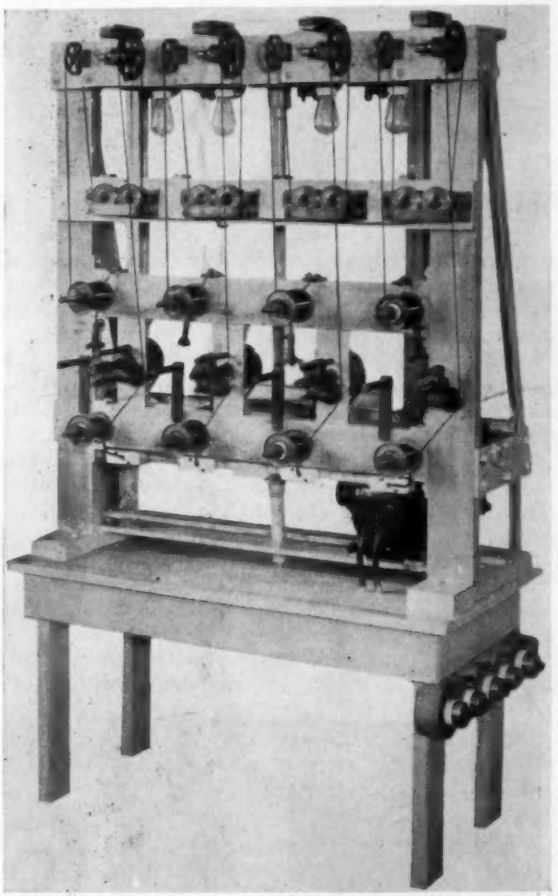
Of Interest to the Trade

What the Telephone and Accessory Manufacturers Are Doing to Advance the Art

Standardization of Enameled Wire

The standardization movement is now sweeping like a gigantic wave over the telephone field, just as the "Safety First" movement swept all industrial plants a few years ago. The Kellogg Switchboard and Supply Company, one of the pioneers in advancement in the telephone field, has now undertaken the standardization of another of its chief products, namely, enameled wire.

On account of the many advantages which this product possesses over the silk insulated wire for certain classes of work, particularly in the smaller sizes, a large number of companies, it is stated, began to manufacture



Special Machine for Testing Enameled Wire in the Kellogg Factory.

enameled wire without giving any thought as to uniformity of product. It is pointed out that a peculiar situation has developed from this state of affairs, in that every customer has been compelled to make his own tests on the enameled wire, developing his own methods and forming his own ideas as to what constitutes an acceptable product.

The Kellogg Company has come to the conclusion that an effort should be made to further standardize the quality of enameled wire, just the same as all other Kellogg apparatus, repeating coils and induction coils, for instance. To carry this thought to a last analysis, no induction coil or repeating coil may properly be standardized unless the materials from which the apparatus is made are uniform.

A special machine, therefore, was built in the modern tool department of the Kellogg Company, purposely designed to accomplish this standardization. As shown in the accompanying illustration, this apparatus has four heads, and is, therefore, capable of testing four spools of wire at the same time.

The method of testing consists in leading the wire through a bath of mercury, from which electrical connections are made to a service relay, which registers the number of breaks in the total length of the wire on any spool. Suitable mechanical means are embodied in the machine, so that at the end of a test of any spool of wire, the total number of feet of wire on the spool is also known. Knowing these two quantities, the average number of breaks for a given length of wire is also known, which is the only criterion for judging the quality of enameled wire.

The speed of the machine is such that an average of 20 feet of wire per minute is tested from each spool. The speed of testing is not constant, but varies with the diameter of the spool and the amount of fire on it. The machine is able to test any size of wire between No. 40 and No. 18 B. & S. gauge. This apparatus is motor-driven and requires very little attention besides the changing of spools.

The Haven Improved Soldering Lamp

A soldering lamp designed by John N. Haven, Walla Walla, Wash., for the use of linemen and electricians, generally, but more especially for linemen working on telephone wires, is shown in the accompanying illustrations.

The gasoline blow torch would hardly be classed as a competitor of this device. Many telephone companies forbid its use for soldering line wires because the extreme heat produced anneals or crystallizes the wires so that they will break from the tension to which they are subjected.

The soldering iron is very slow and not efficient as it will cool before it can be taken to the top of a pole, and a poorly soldered joint is the result; and as for open flame lamps they cannot be considered as they will not remain lighted in a wind and if they do the flame will be so deflected by the wind that the wire will not become heated enough to solder.

For telephone installers, inside wiremen and electric light fixture installers the new lamp will accomplish all that is desired, with the additional feature that it can be used as a lamp for lighting and does not use liquid fuel, thereby reducing the fire hazard.

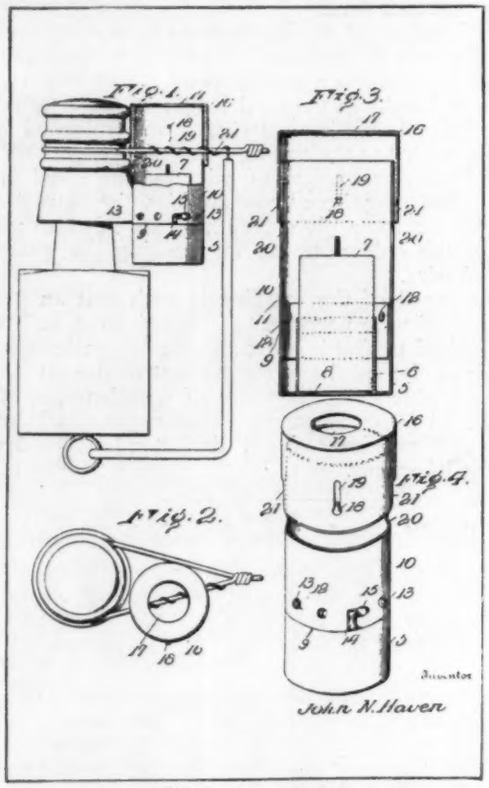
The Haven improved soldering lamp uses a small amount of heat, which, being applied directly to the point wanted, solders the joint perfectly and does not burn or anneal the wires, removing the necessity of using a blow torch or soldering iron with the consequent saving of time.

Considering first cost, it is cheaper than the blow torch and requires no fuel supply other than the candle

which is always carried by the workman, and it can be used for lighting purposes to better advantage than the candle alone as its base acts as a holder or candle stick supporting the candle in an upright position, retaining all the melted tallow. It also tends to greater economy in the use of the candle by protecting it from abrasion which occurs when the candle is carried in the satchel or grip with material and tools.

It can be lighted with a match in strong winds, and by means of a draft regulator will keep a sufficiently steady flame to solder a joint perfectly at all times.

The diagram explains the device and its application. Fig. 1 is an elevation of the appliance, partly in section and in a position for use familiar to every electrician.



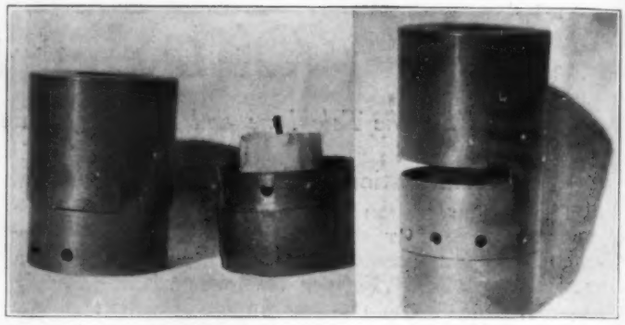
Figures 1, 2, 3 and 4.

Fig. 2 is a plain view. Fig. 3 is a central vertical section, and Fig. 4 is a perspective view.

Referring to the drawings 5 denotes the tubular body which contains a holder 6 for a candle 7. In the bottom of the cylinder is a hole 8 through which the candle may be adjusted in height. The top of the cylinder receives the lower end of the shield 10 which slidably fits around the cylinder and rises therefrom to shield the flame from the wind and concentrate the heat.

In that portion of the sleeve 10 which fits the ferrule 11 of the cylinder 5 are draft openings 13, and the cylinders has openings 12 for the same purpose. The draft may be regulated by turning the sleeve so that its openings 13 register more or less with the openings 12. In the bottom edge of the sleeve 10 is a bayonet slot 14 through which extends a headed stud 15 carried by the side of the part 11, whereby the sleeve 10 is detachably connected to the cylinder 5. The upper horizontal portion of the slot regulates the draft.

The sleeve 10 is closed by a cap 18 fitting over its top, the top of the cap having an opening 17 for the insertion of the solder stick, the cap is held in place by studs which guide the cap by the vertical slots 19, the slot being provided that the cap may be slid up and down when placing the lamp on the wires to be soldered.



The Soldering Lamp, Open and Closed.

In use, the device is placed on the wire by raising the cap 16 a sufficient distance to uncover the slot 20 as shown in Fig. 3 and 4, sliding it on the wire the cap is then let drop so that it slots 21 seats over the projecting wire, thus all draft is excluded at this point and the device is held suspended and the hands of the operator left free for the soldering operation.

Many Visitors at Kellogg Indiana Exhibit

At the Indiana convention the Kellogg company had long tables filling three sides of the big room at "818," at the Sign of the Desk Stand, loaded with a very representative assortment of the parts that make up the reliable telephones and switchboards.

They were displayed in lots of three, six, or more, so that there were always sufficient to go around when discussions on quality or service interested a party of several visitors at a time.

A striking feature of the display was a continuous line along one side of the room of No. 97 desk stand catalogues, illustrating in actual size, that well-known induction coil, condenser type, long distance common battery telephone.

There were a large number of these stands, as well as microphones in all the popular combinations for the various types of service.

Mr. Seeley was kept busy demonstrating the simple Kellogg battery saver for the magneto party line.

John Campbell Interesting Two Young Lady Chief Operators in Some of the Advantages of the Kellogg Operator's Set.

A Kellogg P. B. X. of the new low key shelf type, as well as the large yet compact low key shelf magneto switchboard of 320 lines capacity, was on display.

A Glimpse at One of the Big Tables of the Kellogg Exhibit.

The Kellogg Company furnished as banquet souvenirs gold plated brooch pins that were eagerly sought. Kellogg men attending were: A. J. Carter, general sales manager; B. H. Blake, Indiana representative; J. A. Campbell, Indiana representative; Edward I. Pratt, advertising manager.

There was a brisk demand for Kellogg "More Business" plates and large numbers of the interesting little lantern slide booklets were distributed.

Fred Seeley Demonstrating the Kellogg Battery Saver to Mr. Zimmerman.

Stromberg-Carlson Installations on a Ferry Boat

The S. S. Ontario No. 2, the big car ferry operated by the Ontario Car Ferry Company, connecting with the B. R. & P. Railway at Rochester, N. Y., and the Grand Trunk Railway of Canada, has been completely equipped with a telephone system. The equipment was furnished by the Stromberg-Carlson Telephone Manufacturing Company.

The Ontario makes two trips every 24 hours between Charlotte port of Rochester and Cobourg, Ontario. She is of the ice-crushing type and maintains her schedule in winter as well as summer. Her car-carrying capacity is 28 loaded freight cars on four trucks. The telephone system installed provides means of immediate communication between pilot houses and the captain's, as well as other officers' quarters, the wireless room, etc. The Stromberg-Carlson Company also supplied the equipment for the steam yacht "Florence" now in the service as one of His Majesty's patrol cruisers.

Pittsburgh Wages Increase 45 Per Cent

An unusual wage increase has just been announced by the Pittsburgh & Allegheny Telephone Company for its central office operating forces, effective October 1, last. The announcement states:

"For some time past the management of the company has been considering what financial plans for the central office operating forces would best be established in order to permit those forces to financially keep pace with the increased cost of living, and it has just been decided that in order to meet existing conditions, and in recognition of the loyalty and faithfulness displayed by those forces during a period of unusual business activity, their wages are to be increased to the extent of approximately 45 per cent of the existing central office payrolls."

New Buffalo Location for Western Electric

The Western Electric Company has moved its offices and show rooms in Buffalo from 98 Terrace to 709-711 Main street. The new location with two large show windows fronting on as many streets affords splendid display facilities. The full line of Western Electric quality products will be carried and the high standard of service that marked the company's business at the old office will be strictly maintained at the new. J. W. Tabb is the manager.

Western Electric's New Buffalo House.

Uncle Sam's Maps at a Premium

That Uncle Sam's topographic maps are appreciated by public-utility corporations is shown by the fact that telephone companies throughout the United States are constant purchasers. These companies send frequent orders to the Geological Survey, Department of the Interior, for its maps in lots of 250 or 500, and occasionally when some big contract has been landed as many as 1,000 maps are ordered at a time for the use of the engineers and linemen. Some electrical-supply companies keep complete sets of the maps of areas in states in which they expect to do extended work, and when they hear that contracts are to be let for such work they refer to these maps, and with the "lay of the land" before them can tell at a glance the character of the work that will be required and can make their bids promptly and intelligently. The telephone officials who are "using the maps extensively" state to the Survey that they are of "indispensable value" in their work.

Western Electric Gross Sales Will Reach $100,00

While the other two members of the electrical "Big Three" have been enjoying record prosperity, Western Electric has not been sitting idly by.

The company's previous biggest year's gross was $77,000,000. This year sales will be not far from $100,000,000. This refers to actual shipment of goods to customers. The incoming orders booked will be very much greater than $100,000,000.

While Western Electric claims no war orders, it has felt the effect of the war by limitation of raw material supplies on the one hand and an abnormal demand for its products on the other.

Directors recognize the fact that present conditions are entirely abnormal. At the same time the pressure is here and cannot be entirely ignored. As a result directors have authorized plant additions which will call for the expenditure of over $1,000,000.

Western Electric is now employing 23,000 people, the largest number in its entire career.

South Dakota Convention in January

The South Dakota Independent Telephone Association will meet in Aberdeen on January 16, 17, 18, 1917, with headquarters at Hotel Ward. Ample accommodations are guaranteed by the manager and a program of exceptional interest will be presented.

The Telephone Commission has signified its intention of holding an institute for the purpose of bringing about a more uniform system of bookkeeping which it is hoped can be held at the same date, and a school for operators will be held at which a large number will be in attendance. A banquet and theater party will be a part of the order of business on one evening.

It is the hope of the officers and members of the Association that a large number of the officers of the many Independent companies of the state will avail themselves of this opportunity to co-operate with the Association in building up both the business and the Association.

Stromberg-Carlson Telephone Manufacturing Company's Bulletin No. 1010, on "Central Energy Telephones," describes in detail the company's product in that line, with both half-tone illustrations and diagrams.

A catalog of insulators from 1,000 to 1,000,000 volts, is Bulletin No. 14, of the Electrose Manufacturing Company, a 28 page book.

Mr. Vail Has a Past

Who was the greatest baseball pitcher that ever lived—John Clarkson, "Ed" Walsh, old "Cy" Young, "Christy" Mathewson, "Eddie" Plank, or Theodore N. Vail?

Once upon a time a youngster named Vail pitched out in Iowa. He was not only a good pitcher, he was a great pitcher; a star of the first magnitude in the baseball world—a man who, according to John J. McGraw and Connie Mack, ruined his life by forsaking the diamond for the telephone field.

"Look at him today," said McGraw, "nothing but the president of the American Telephone and Telegraph Company! Why, he might ha' had my job—he might ha' been the manager of the 'Giants' if he'd 'a stuck to the game!"

And here is what Mr. Vail himself has to say, according to an interview the press credits him with having given out last month:

"I probably wouldn't shape up very well in the pitcher's box today, but there was a time when I was reckoned a pretty good player. I headed a real baseball team out in Iowa. I pitched against the great 'Pop' Anson, and we won two out of five games from his club.

"I hold the belt of the champion pitcher of Iowa. At the time I won it, it fitted comfortably around my waist. Now it would go just about around my neck. It is one of my most valued possessions.

"Do I still retain my interest in our national game? Oh, yes; I am as enthusiastic as ever. I was rather banking on seeing the Giants win the pennant this year, but they seem to have lost their stride. I find some consolation in the fact that Brooklyn is doing so well. They are playing fine ball just now, and I hope the team will keep it up."

Now it's up to us to philosophize a trifle, and to inform all young men who are ambitious of becoming high telephone officials that the proper caper is to go out on the vacant lot next door each evening after their day's work, loosen up the ol' "whip," and see how much "stuff" he's got. Then, if he can show speed, curves, and control, to say nothing of winning a belt for being the champion pitcher of his state, he should forward his application to headquarters, where it will be filed and given careful consideration every time a vacancy occurs!—*Southwestern Telephone News.*

If the boss don't know you are living, whose fault is it?

Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of TELEPHONE ENGINEER, published monthly, at Chicago, Ill., for October 1, 1916

State of Illinois, County of Cook, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Paul H. Woodruff, who having been duly sworn according to law, deposes and says that he is the Editor of TELEPHONE ENGINEER, and that the following is, to the best of his knowledge and belief, a true statement of the ownership and management of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Electricity Magazine Corporation, 1251-1256 Monadnock Bldg., Chicago.

Editor, Paul H. Woodruff 7025 Yale Ave., Chicago, Ill.

Managing Editor and Business Manager, Ed J. Mock, 9345 Pleasant Ave., Chicago, Ill.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Ed. J. Mock - - - - 9345 Pleasant Ave., Chicago, Ill.
B. C. Sammons Estate - - - - - - Blue Island, Ill.
John Crocker - - - - - - - - Moroa, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: There are no bonds, mortgages or other securities outstanding against TELEPHONE ENGINEER.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

PAUL H. WOODRUFF, *Editor.*

Sworn to and subscribed before me this 30th day of September, 1916.

(Seal) Leona J. Ekstrom.

My commission expires Aug. 17, 1917.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

PERSONAL NOTES.

W. R. McGovern has been appointed chief engineer of the Central Group of Bell telephone companies, succeeding James G. Wray, who resigned and will hereafter be associated with the engineering firm of Hagenah and Erickson. Mr. McGovern, who was formerly state engineer for the Chicago Telephone Company, is succeeded in that position by J. S. Ford, formerly building engineer in the state engineering department. James I. McDonald has been promoted to the position of building engineer, succeeding Mr. Ford. Mr. McDonald was formerly general building inspector in the state engineering department of the Chicago Telephone Company. Mr. McGovern, the new chief engineer, is a native of Milwaukee and a graduate of Marquette University. He started in the telephone business in 1899 with the Erie system, which embraced the Wisconsin, Michigan, Northwestern, Southwestern, and Cleveland companies. When the construction department of this system was abolished in 1901 he went with the equipment department of the Wisconsin Telephone Company at Milwaukee, running the gamut of traffic, maintenance and construction work, holding such positions as traffic inspector, equipment installer, line foreman, etc., finally working up to equipment engineer and chief engineer of the Wisconsin Telephone Company. His experience in these positions has included most of the work from making blue prints to the engineering and construction of the largest exchanges in Wisconsin, including a part of Milwaukee. When the Central Group was formed in 1911 Mr. McGovern was transferred to Chicago and appointed to the position of engineer of inventory and appraisals for the five companies. On August 1, 1912, he was appointed to the position of engineer for the state of Illinois, embracing all the property of the Chicago Telephone Company, city and suburban, and the Central Union Telephone Company in Illinois. In 1914, the property of the Central Union in Illinois, having been placed in a receivership, was withdrawn from the state engineering department. Mr. McGovern is an associate member of the American Institute of Electrical Engineers, a member of the Chicago Association of Commerce, the Traffic Club and the Electric Club.

W. R. McGovern.

Harry H. Gribben, superintendent of the Oakland, Cal., factory of the Standard Underground Cable Company, died suddenly, September 25, at his home in Oakland, aged 56 years, 8 months and 7 days. Mr. Gribben was a native of Pittsburgh, Pa., and lived there until 1899, when he moved to California to take charge of the factory which the Standard Company had then just completed. Previous to this he was general foreman in the company's Pittsburgh factory. He had been in the employ of the Standard Company for over thirty years and was one of its most faithful, loyal and competent superintendents, and a man who by his personal qualities endeared himself not only to his business associates but to every one with whom he came in contact. At a recent meeting of the board of directors suitable resolutions were passed expressing the Standard Company's sense of loss in the passing away of one of its oldest employes in point of service. Mr. Gribben was a member of the First Presbyterian Church of Berkeley, Cal.; a trustee of the Oakland Y. M. C. A.; director of the Mount Hermon Association and San Francisco Bible College; a member of Duquesne Lodge No. 546 F. & A. M., Pittsburgh, Pa.; Sierra Council No. 1642, Royal Arcanum, and Forest Camp No. 102 W. O. W. He is survived by his wife, Mrs. Carrie Thompson Gribben. Interment took place in Mountain View Cemetery, Oakland, Cal.

George B. Wellbaum, advertising and sales manager for the Dallas Automatic Telephone Company in Texas, has become commercial superintendent for the Automatic Telephone Company in Indianapolis, Indiana.

Clyde Curry, lineman for the Lafayette County Telephone Company in Darlington, Wisconsin, has accepted a position with the Wisconsin Telephone Company at Milwaukee.

Martin Hooley, city foreman in the plant department of the Watertown branch of the New York Telephone Company, resigned October 7 on a pension. Mr. Hooley is succeeded by Frank L. Pike.

I. R. Allen, has been appointed manager of the Boone and Ogden telephone exchanges of the Boone County Telephone Company, Iowa, succeeding O. P. Shurtz, recently resigned.

Edward E. Backus, aged forty-eight years, a well known telegraph, telephone and signal engineer, died at Oeilwein, Iowa, October 2, from the effects of a paralytic stroke. He was born in Virginia, and became an operator in 1883. He had a wide experience on several railroads and also with the Western Union and Mutual Union Telegraph companies. During 1887 he was manager for the Western Union in Bridgeport and Danbury, Conn., and in 1888, came to the New York office, becoming Wheatstone chief in 1889. In 1890, he was traffic chief of the through western division and in 1891, was transferred to the Lynchburg, Va., office as quadruplex and Wheatstone repeater chief. In 1892, Mr. Backus was engaged in construction work on the Quinby railroad concession in Venezuela, South America. Later in the same year he returned to New York City, where he joined the staff engineering department of the American Telephone and Telegraph Company. In 1898, he was appointed construction engineer for the New York and New Jersey Telephone Company, becoming assistant division superintendent for the New Jersey division in 1900. From 1902 to 1907, he was superintendent of plant for the same company. Between 1908 and 1911, he was engaged in developing selectors for railroad telegraph service and in the latter year became superintendent of telegraph and signal engineer for the El Paso and Southwestern System, at El Paso, Tex. At the time of his death he was in the employ of the Chicago Great Western Railroad. Mr. Backus was one of the organizers of the New York Telephone Society. He was a member of the Association of Railway Telegraph Superintendents, the Railway Signal Association, and the American Institute of Electrical Engineers.

Ed. G. Morgan has been elected as superintendent of the Pomeroy and Middleport Telephone Company, at Pomeroy, Ohio, by the board of managers.

H. M. Fellows has been appointed manager of the Kaukauna exchange of the Wisconsin Telephone Company. Mr. Fellows succeeds Frank E. Schmidt, who recently died.

L. W. Davis, who has managed the telephone system in Malvern, Iowa, for the past two years has resigned, and C. R. Beers of Council Bluffs is his successor. Mr. Davis will engage in business for himself.

C. M. Mauseau, former general manager of the Northwestern Telephone Company, visited in Minneapolis, after an absence of seven years. Mr. Mauseau is head of a telephone system in Rio de Janiero, Brazil.

Joseph Schroeder, for some time manager of the Northwestern Telephone Company in St. Cloud, Minneosta, has resigned his position. The name of his successor has not been announced.

At a special meeting of the board of directors and the stockholders of the Ellsworth Mutual Telephone Association, in Ellsworth, Iowa, George B. Bergeson was elected secretary to fill the vacancy caused by the death of the former secretary, Holden Thompson.

G. A. Mummey, in charge of the lines at Akron, Iowa, for the Farmers & Merchants Telephone Company, will come to Hawarden as district manager on November 1. Mr. Mummey

will be assisted by Elmer Frank, while Sterling Pierson will be transferred to Fonda.

Death recently claimed Elery D. Mooar, superintendent of construction of the United Home Telephone Company in Muskegon, Michigan.

J. H. Ainsworth of Youngstown, has been appointed special representative of the Ohio State Telephone Company in the commercial department at Columbus.

BREVITIES OF THE BUSINESS.

CANADA.

Officers elected for the Telephone Institute of British Columbia for the ensuing year are: President, E. P. LaBelle, plant engineer; first vice-president, R. W. Pindar, wire chief; second vice-president, E. M. Ober, traffic engineer; secretary, R. B. Bennett; treasurer, John Granger, auditor.

ILLINOIS.

The Central Union Telephone Company has installed between 4,000 and 5,000 feet of new cable south on State street from the Central office, Beardstown.

The Mutual Telephone Company is rebuilding its line from Chadwick to the Adolphe neighborhood, also several branch lines.

The members of the Farmington Telephone Company held their annual meeting and re-elected the old directors and officers. It was recommended to purchase a new switchboard and voted to declare dividends of $20 per share. The following are the officers: S. P. Wood, T. E. Crane and F. S. Vandersloot, directors for three years. They also elected the following officers: President, F. S. Vandersloot; vice-president, Dr. J. W. Connelly; secretary, Dr. A. H. Fash; treasurer, E. L. Parks.

A new telephone line is being built at Guilford.

The Macon Independent Telephone exchange, which has been owned by Franklin Orton, of Lincoln, for the past two years was recently sold to Mr. Sterritt, of Henry. Sterritt is interested in and the manager of quite a number of central Illinois exchanges, including Clinton, Sullivan, Illiopolis, Niantic, Carlinville, Girard and Virden.

R. D. Wallace, state supervisor of the Central Union Telephone Company, has a force of workmen employed nights at the Beardstown central office installing three new positions at the switchboard.

Standard Telephone Repair Company, Chicago; capital, $2,500. Incorporators, J. S. Kinderviken, I. M. Darmody, Nathaniel Rubinkam.

Vermilion Mutual Telephone Company, Cullom; capital stock increased from $1,500 to $4,687.50.

Plymouth Farmers' Switchboard Company, Plymouth; capital, $4,000; incorporators, Thomas A. Jeffries, Fred E. Hendrickson, John E. McWhorter.

INDIANA.

The Prairie Telephone Company of Brookston, with its main exchange at Brookston and toll lines to Lafayette, Delphi, Monticello and Reyonlds, has been sold to L. S. Conorroe, a former Tipton grain merchant. J. H. Kneale and Ira Borden, both of Brookston, held the majority of the stock and they completed the deal. The consideration was not made public.

Daviess County Home Telephone Company, Washington, field final certificate of dissolution.

Indianapolis Telephone Company, remodel, 1025 Prospect, Indianapolis, $150.

Knox County Home Telephone Company, Vincennes, filed certificate of dissolution.

The Central Union Telephone Company has installed a private branch telephone system in the store of L. S. Ayres & Company, Indianapolis.

Bedford Home Telephone Company, Bedford, filed certificate of dissolution.

Indianapolis Telephone Company, repairs, 230 North Meridian. $200.

The eleventh annual meeting of the Farmers' Mutual Telephone Company of Whitney County was held October 12 and a large representation of officers and stockholders were present to hear the annual reports and assist in the election of officers for the year which follows: President, A. A. Bush; vice-president, E. E. Rindfusz; secretary, Clinton Wilcox; treasurer, W. H. Carter; manager, R. R. Scott; township vice-presidents and directors: Cleveland, Thos. Jellison; Richland, E. E. Rindfusz; Etna and Troy, Melvin Blain; Washington, J. A. Mullet, Columbia, W. H. Carter and Clinton Wilcox; Thorncreek, Isaac Humbarger; Jefferson, Jacob Kaufman; Union, Albert Bush; Smith, Irvin Kreider; advisory board, A. A. Bush, Clinton Wilcox and W. H. Carter.

Bloomington Home Telephone Company, Bloomington, filed final certificate of dissolution.

IOWA.

The semi-annual stockholders' meeting of the Mutual Telephone Company was held on the afternoon of October 2, at the courthouse, Greenfield. The following directors were elected to serve three years: Chas. Hoepner, J. E. Wallace, and J. H. Jones. J. E. Brooks was elected secretary and W. R. Goodman elected treasurer for the ensuing year.

The Mt. Vernon Telephone Company has decided to build their telephone line into Clear Lake. The part built will begin near Charley Knarr's and extend directly north into Clear Lake.

Mrs. A. F. Lashier and Miss Adele Lashier have been chosen to take charge of the Farmers' and Merchants' Telephone Company at Early, succeeding Misses Mabel Strubel and Gladys Cook, resigned.

At the annual meeting of the North English Telephone Company, held at the city hall, the following officers were elected: President, Frank Warner; vice-president, Elmer Brown; secretary, T. M. Thompson; treasurer, Rae L. Dean; director, Hiram Miller.

The Providence Mutual Telephone Company met in the school house and elected the following officers: B. C. Lybarger, president; J. M. Clemons, vice-president; E. H. Moon, secretary and treasurer; Robert Beach, A. Rhodes, Geo. Elerding, executive board; A. R. Benbow, switch tender.

KANSAS.

Work has been commenced on the new building for the Missouri & Kansas Telephone Company in Lyons. It will be of stucco construction and will cost upwards of $5,000. The construction work will be rushed as much as possible.

The Cuba Telephone Company has issued a new directory.

KENTUCKY.

A crew of the Tri-State Telephone Company, of Barbourville, has started work on a long distance extension from Barbourville to Manchester, a distance of twenty-four miles. The route follows the right of way of the Cumberland & Manchester railroad. The railroad company, it is stated, will use the telephone line for the dispatching of trains.

Flat Woods Licking River Telephone Company, Licking River, capital $306; incorporators, Bruce Lewis, E. C. Wells, J. B. Wells.

A voluntary petition in bankruptcy was filed in the Federal Court in Louisville by James A. Winfrey, manager of the Casey County Telephone Company and a well-known farmer. He lists liabilities of $8,836.57, and assets of $10,144.

S. D. Hughes, of Winchester, has purchased the lines, equipment and business of the Hazard Telephone Company at Hazard, with hundreds of miles of lines in Perry, Breathitt and Leslie counties. The deal involves several thousand dollars.

LOUISIANA.

The last of the telephone poles on Parkerson avenue, Crowley, are being removed by a crew of workmen for the Cumberland Telephone Company.

Poles of the Cumberland Telephone Company were burned and the wires put out of commission for several hours when a fire almost destroyed the business district of Sibley.

MICHIGAN.

Contracts for construction of a large two-story addition to the Hickory telephone exchange, on Lycaste and Kercheval avenues, Detroit, have been let by the Michigan State Telephone Company. Specifications call for a building 40x80 feet. This will give the Hickory office a frontage of 82 feet and will make it one of the largest in the city used for telephone exchange purposes. Switchboard capacity will be added to accommodate sufficient equipment to last till 1927. The Michigan State Telephone Company is doing an unusually large amount of construction work this year. The new East office, Congress street and McDougall avenue, is in course of construction. A second story is being added to the North exchange, providing 2,800 feet of additional floor space. The new Lincoln Office is well under way. The addition of a third story to the Walnut office was completed a few months ago. Plans are being made for still further building activity.

Mundy Telephone Company, Swartz Creek, $10,000.

The Citizens Telephone Company, of Grand Rapids, quarterly dividend will be paid October 20, and will be a disbursement of nearly $60,000.

W. F. Benoist, representing as civil engineer, the Automatic Telephone Company of Chicago, was in Grand Rapids, conferring with officials of the Citizens Telephone Company regarding new apparatus for the exchange at Hastings, and John Wicke, toll line expert, regarding automatic dials for exchanges outside Grand Rapids.

Galesburg's telephone exchange has moved from the Damarell building to the Lawrence house on Main street.

MISSOURI.

The annual meeting of the Farmers' Mutual Telephone Company was held in the directors room of the Northwestern bank at Burlington Junction. The principal business was the election of a director for a term of three years and George C. McKnight was re-elected to succeed himself. He is secretary of the board; L. O. Staples is president; U. S. Reavis, vice-president, and R. N. Barber, treasurer.

The Bell Telephone Company has a force of men at work rebuilding the lines between Kirksville and Queen City. When this work is completed the company will have a complete new copper circuit from this place to Lancaster, including new poles.

The Home Mutual Telephone Company of Caldwell County held its annual meeting in Kidder. The following constitute the officers and directors for the coming year: Judge A. F. Howard, president; Joe Hamlet, vice-president; Roscoe L. Terry, secretary; J. N. Gittinger, treasurer. H. S. Buck, H. S. Knoch, Jesse Ream, James McBride, E. P. Writt, Walter Stephens was retained as lineman and with the assistance of Mrs. Stephens is in charge of the central office.

J. A. Davenport of Chillicothe has purchased the stock of the Hale Telephone Company, and will assume control November 1.

MONTANA.

The federal government is constructing a telephone line through the Township forest reserve with the idea of affording better fire protection.

Upon the failure of a part of the stockholders of the rural telephone line north of Corvallis to pay quarterly toll to the Mountain States Telephone Company, the rural line has been disconnected from the main line.

NEBRASKA.

The Wynot Telephone Company have installed a fine new switchboard in their central office.

The meeting of the directors of the Farmers' Telephone Company of Dodge County was held at the Commercial Club rooms in Fremont. The only change in the directorate for the coming year was the selection of A. J. Hasson, of Dodge, to serve on the board instead of Frank Meyers, who resigned on account of removal to Omaha. The directors again elected the officers who have been managing the business the past year, viz.: Fred Howe, president; John Drenguis, vice-president; Thos. H. Fowler, secretary, and C. L. Kelley, treasurer. The executive committee is composed of Henry Spath, John Drenguis and Henry Tank.

It is rumored that the farmers' unions are working together to build a line from Guernsey to Bridgeport.

NEW YORK.

The annual meeting of the Barrington and Wayne Telephone Company was held in Grange Hall, Barrington, September 30, and the following officers elected: President, Benjamin I. Kenyon; secretary, Harry Dibble; treasurer, Martin Beilis.

The New York Telephone Company is arranging to build a new $150,000 building on South street, Auburn, to house the company's equipment and offices.

OHIO.

E. G. Miller of the Warren & Niles Telephone Company was in Chicago purchasing an additional section for the switchboard.

A. Davenport of Chillicothe has purchased the stock of the Hale Telephone Company, and will assume control about November 1.

The annual convention of independent telephone companies of the state will be held at the Hartman hotel in Columbus, November 23 and 24. On the first day of the convention a joint session will be held and the telephone men will be addressed by speakers of national reputation. The annual banquet will be held in the evening, and on the second day division meetings will be held at which special phases of telephone management and operation will be discussed.

It is now given out that plans are under way for the erection of a telephone plant in Cuyahoga Falls, with the installation of new switchboard and other up-to-date equipment and to this end an option was secured by officials of the company on Fred Hatchel's residence property on Second street, where the company will build a two-story brick building for their central headquarters.

October 14, the Home Telephone Company in Bowling Green put their new switchboard into operation.

E. G. Walsh & Brothers, contractors, have received the contract to build the new Bell telephone exchange on Columbus avenue, between Adams and Jefferson streets, Sandusky. The structure will cost about $100,000.

Farmers have protested against raise in telephone rates in connection with the proposed merger of the Bell and Independent interests in Galion.

A reduction in rates of the Ohio State Telephone Company has been announced by Rollo E. Stevens, general commercial superintendent, in Cleveland, to meet competitive conditions. Gross charges for flat rate service, one and two-party business and one and two-party residence lines have been reduced $1 a year. Individual line measured service will be $2 a year cheaper. Four-party residence service will be 50 cents a month cheaper with a 50-call limit.

PENNSYLVANIA.

Through an announcement by S. L. First, local manager of the Bell Telephone Company of Pennsylvania, it was learned that the "turn the crank" telephone system in Mechanicsburg will soon be replaced with a complete new common battery system to be in operation January 1, 1917.

The Bell Telephone Company has appointed Miss Mary Meehan as chief operator at the Mahanoy City exchange to succeed Miss Kathryn Mulvey, resigned to remove to Massachusetts.

"The Voice of the Liberty Bell" was the title of a picture shown recently by Manager S. B. Watts of the Bell Telephone Company in Harrisburg at their building, 210 Walnut street.

One hundred or more men, representing the construction and installation forces of the Bell Telephone Company, in Chester county, gathered October 7 in the West Chester Y. M. C. A., the object being to consider avoidance of accidents and recommend methods of safeguarding employes in their work.

The Keystone Telephone Company has declared the regular semi-annual dividend of 3 per cent on the preferred stock, payable November 1 to stock of record October 20.

The Norristown-West Chester Telephone Society, composed of employes of the Bell Telephone Company of Pennsylvania in the districts of Norristown, West Chester, Coatesville, Pottstown, Doylestown and Phoenixville, held its first meeting October 13 for the coming year. These meetings are held monthly and for the purpose of educating the employes of the telephone company as to how a more efficient job can be done and to the satisfaction of the general public. The byword of this society is "Courtesy and Efficiency." The following is the result of the election: G. W. Kerney, West Chester, president; R. Binder, Coatesville, vice-president; C. R. Green, Norristown, secretary and treasurer.

The Bell Telephone Company is constructing a cable from South Lansdowne avenue to Aldan, along Providence road, Fernwood.

SOUTH DAKOTA.

Hon. P. W. Dougherty, of Pierre, a member of the state board of railway commissioners, held a meeting with the subscribers to the Parkston rural telephone lines in Parkston to discuss matters pertaining to rates for company service. The board heard the arguments advanced, both for and against a raise in the rates, and will render a decision later.

TEXAS.

Since installation of improved telephone service in Snyder local charges have been increased 25 per cent on both business and residence rentals, effective October 1.

The Southwestern Telephone and Telegraph Company has taken over the Texas Long Distance Telephone Company. The transaction has been pending for several months. The new lines extend 170 miles from Beaumont and add three additional counties to the district over which G. J. Todd has supervision. This district is now composed of the following counties: Jefferson, Chambers, Hardin, Newton, Orange, Jasper, San Augustine, Shelby, Nacogdoches, Angelina, Cherokee, Liberty and Tyler and portions of Galveston, Sabine, Panola and Smith counties.

The Gilmer telephone exchange has begun the erection of an up-to-date building to be used for the offices of the company.

The Local Owners' Telephone Association of Texas will hold a two-day session at the Metropolitan hotel in Fort Worth, beginning October 25.

WASHINGTON.

The Pacific States Telephone Company, which took over the old telephone system several months ago, has put into service a new, modern exchange in the large telephone building on Second street between Lewis and Clark streets, Pasco. The improvements cost about $25,000 and the new plant is sufficient to care for the present business and also provide for a future growth. The toll center has been re-established in Pasco.

S. P. Crim, representing the Pacific States Telephone Company, and S. A. Miller, of the British Columbia Telephone Company, were in conference in Molson and decided to connect the two telephone systems at the international boundary line, two miles north of here.

WISCONSIN.

The regular quarterly meeting of the board of directors of the Wisconsin Telephone Company was held September 28 in the general offices, 183 Fifth street, Milwaukee. Expenditures amounting to $877,944, covering new construction and repairs to the plant of the company in Milwaukee, and $420,903, covering new construction and repairs to the plant of the company in the state, outside of Milwaukee, was approved. A net gain in stations of 7,806 was made during the first eight months of the year, as compared with 3,781 during the same period last year. The average number of employes in the service of the company during August of this year was 4,213, compared with 3,575 during the same month last year. The regular quarterly dividend of $2 a share, payable September 30, was voted.

The Wisconsin Telephone Company has completed the inspection and repair trip to Necedah, and will now inspect the Elroy line.

The Bell Telephone Company in Sturgeon Bay held their annual "visiting day" October 17, which was largely attended.

The Story of the Asheville Flood

In Asheville, N. C., the public service corporations were all seriously crippled by the heavy floods which occurred last summer. All power lines from the water power plants on the river which supplied the city with light and power, were washed away, and the emergency steam plant and gas plant were submerged, leaving the city without light or power of any kind except gasoline and kerosene. The supply of oil was limited on account of the tanks of the Standard Oil Company and Texas Oil Company having been washed away, says E. P. Hamilton in the *Southern Telephone News*.

Our company kept service going in all sections of the city except where the lines and cables crossed the river, all of these crossings having gone down with the bridges. The toll lines west were also washed down, but the lines south held.

As the lights were all off, no street cars running, and the gas shut off, the only means of communication was by the telephone, and it was certainly used. Our load immediately jumped from normal, about 25 amperes, to 80 amperes, as people called their relatives and friends whom they were unable to reach by any other means.

Carrying a load of 80 amperes without means to charge the batteries would soon have put the telephones out of commission, so a method had to be devised to get a gasoline engine installed, and to do it immediately. It was Sunday, so none of the business houses were open, but we found a small engine on a concrete mixer which could be used, and arrangements were made to install it in place of our emergency engine. This we did and at eleven o'clock were charging the almost exhausted batteries.

In the meantime we were purchasing gasoline wherever it could be bought on account of the supply being limited to what was in the tanks of the different garages. We were able to get enough to keep going for a few days, when the city officials confiscated all that was left, so that they would be able to supply the ambulances, fire trucks and other important machines used by them, and also to stop unscrupulous dealers who were charging exorbitant prices, some as high as $1.00 per gallon.

Kerosene oil for lights was very scarce, not much being used in the city, and as we had to have light, it was necessary to fall back on the kerosene lamp. We purchased enough lamps to light the building and sent across the mountain, where they had no electric lights, to get enough kerosene oil.

While this work was in progress in the central office, a force of men was sent out to clear away as much of the wreckage as possible and to guy up poles that were in a dangerous condition to keep from falling.

Monday morning the water had not receded very much, but by that night was below the danger point, and on Tuesday we were able to make an effort to restore service to the subscribers in the flooded sections. All of the instruments had to be changed and stations rewired as they stood under water for two whole days. Some of the stations could not be restored until the buildings were dried out, and some were entirely washed away and subscriber had no place to put instrument. By Saturday, July 22, practically all of the stations were back in service except West Asheville, the two 100-pair cables feeding that place being down the river, and the new cable ordered had not been received. On account of the uncertainty of getting the cable, as the railroad facilities were limited to one branch road, temporary connection was made by taking the cable on hand and that recovered after the water went down and placing it on a temporary messenger laid on the pieces of the old bridge that were left standing, and in this way service was restored to all stations in about two weeks.

Cleveland Cannot Force Merger

City Law Director W. S. FitzGerald of Cleveland, O., reports to council that the city has no authority to compel the telephone companies in Cleveland to combine. His opinion was asked in a resolution offered by Councilman E. A. Meyers several weeks ago.

The city will not appeal from the Cleveland Telephone Company valuation decision of the state public utilities commission. The council committee on telephone and telegraphs decided at a meeting recently with Assistant City Law Director R. B. Wickham that it would be inadvisable to engage an expert for this purpose.

In the opinion of members of the commission the valuation as fixed by the commission is fair. Councilman E. A. Meyers asked the assistant law director for an opinion as to the power of the city to compel the two companies to combine. In the opinion of the director there is no way in which the city can force the consolidation.

Subway and Elevated Telephones

The question of installing telephones in New York City's subway and elevated railroad stations without delay, it is stated, is entirely in the hands of the Interborough Rapid Transit and the Brooklyn Rapid Transit Companies. The New York Telephone Company asserts with pride that it has placed telephones wherever they could possibly be of convenience to the residents of the city.

The Public Service Commission is eager to do all it can to push the installation of this convenience, for which many persons have declared themselves.

The commission, however, cannot act until the railway and telephone corporations have reached a decision. That body cannot demand or enforce the installation of the telephones at the transit stops, as it is held not a question of safety or service.

The Montreal-Vancouver telephone line, recently opened, is the longest in the world. The line is 4,227 miles long as compared to the 3,400 miles of the New York-San Francisco line. The Montreal-Vancouver line does not run direct through Canada but instead for the greater part passes through the United States, touching the following connecting points: Buffalo, Chicago, Omaha, Salt Lake City, and Portland, Ore.